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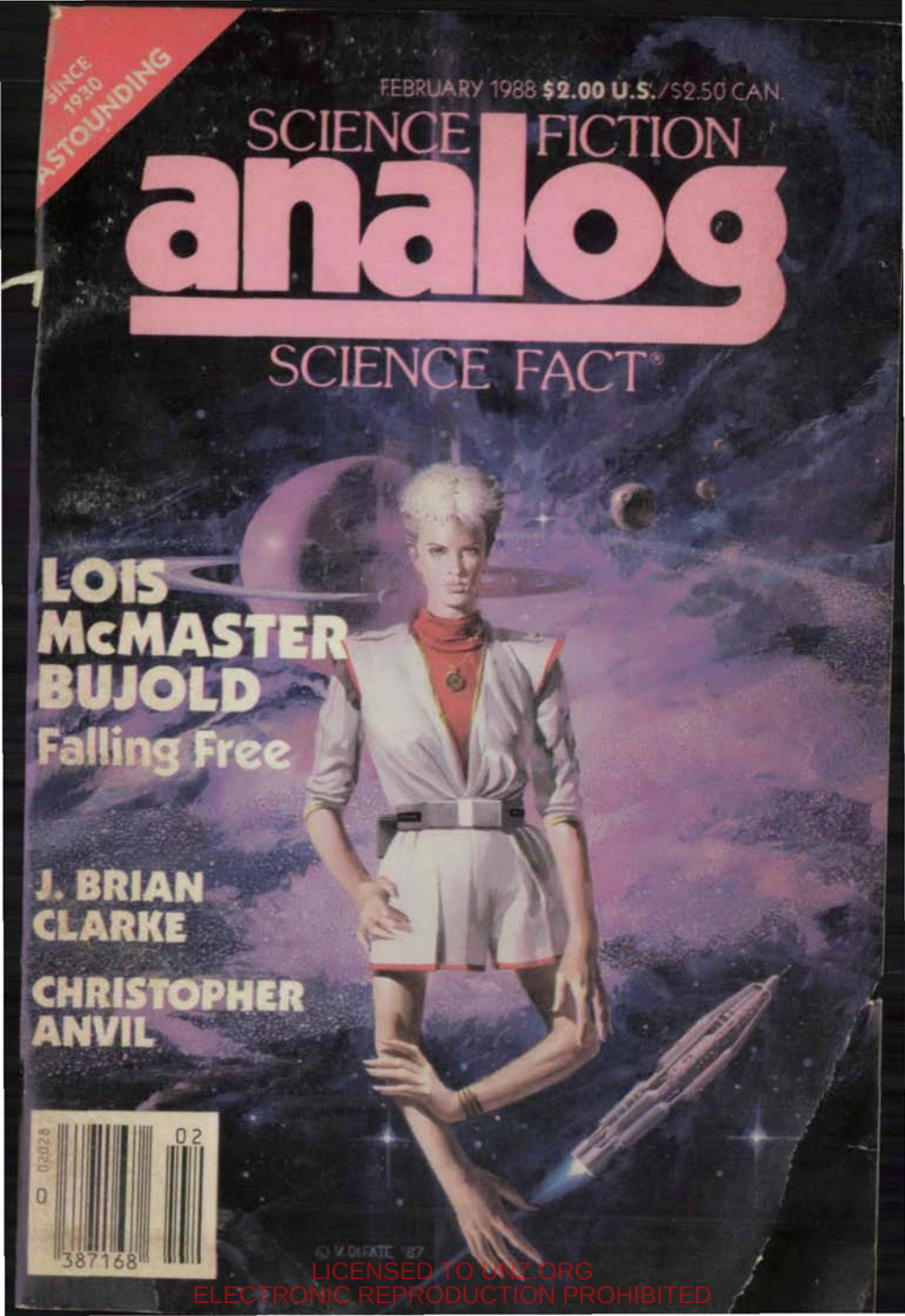

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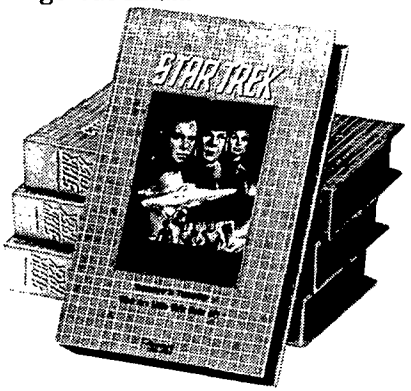

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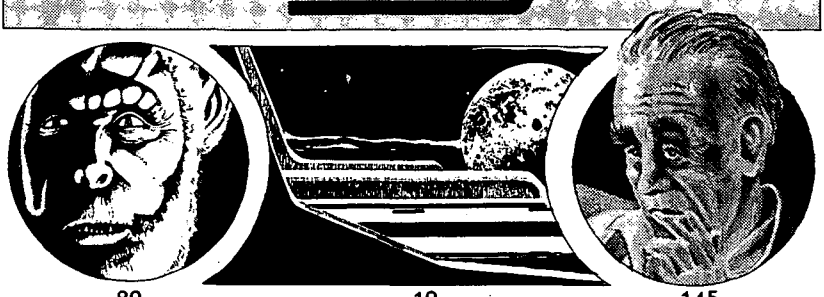

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Editorial

. . . AND JUSTICE FOR ALL

Stanley Schmidt

We all remember the last line in the Pledge of Allegiance: ". . . with liberty and justice for all." Surely a high and admirable ideal—but is it being delivered as advertised?

There's another high ideal in the Sixth Amendment to the U.S. Constitution: "the right to a speedy and public trial." "Public" nobody can deny—but can anyone who reads the papers now read the word "speedy" in this context and keep a straight face?

There seems to be a problem here. My question in the first paragraph did not refer to whether the laws, or the courts' applications of them, are fair or equitable. The problem is at a far more practical level: how often do the laws get applied *at all*, or in time to provide any satisfaction? Under existing law we all enjoy an impressive array of rights—or we would, if we could afford to take advantage of them. We have gotten ourselves into the mildly paradoxical situation of having a civilization which promises its citizens an unprecedented degree of protection from abuse by others, but makes it practically impossible for many of them to claim that protection. Doing so requires taking a dispute to court; and court costs and lawyers' fees have become so high that no one can afford to do that unless he is already quite well off, or the amount he expects to collect is quite large and he has reason to be quite confident of winning. I saw an article recently in which a lawyer quoted a minimum amount that was worth suing for; I don't remember the exact figure, and a different lawyer would probably quote a different one, but it was of the order of hundreds of thousands of dollars. True, there are small claims courts specializing in simple cases involving *very* small amounts of money. But in between, there is a "no man's land" involving "moderate" amounts which the rich consider small but to the not-so-rich are quite

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significant. This is the domain of the middle-class homeowner who has been ripped off to the tune of a few thousand dollars by an unscrupulous contractor. He can't afford the loss of the few thousand dollars—but still less can he afford to lose those *plus* the additional thousands in costs he'll owe if he sues for the original damages and loses. He knows courts are capricious enough so he can't be *sure* of winning, even though he has a strong case—so he doesn't dare take the gamble. So he does nothing and absorbs the loss and the resulting hardship. The law is on his side—but he literally can't afford to bet that a particular court will recognize that.

So, over and over, the relatively little guy gets stung and can't sting back. Legally, he can; practically, he can't.

And if he does decide to bet that he's right, it may be *years* before a court actually gets around to giving him a decision; and in the meantime, the time spent in courtrooms may cost him his livelihood. It's true that the Sixth Amendment refers specifically only to *criminal* cases, but I think it's safe to say that the citizens who applaud the ideal expressed therein would prefer to see it applied to *all* kinds of cases. (And what they want *is* important. This is a government of, by, and for the people. Right?)

The slowness and expense of legal proceedings are not unrelated, of course. Part of the problem is that court procedures are intrinsically slow. They are conducted by human beings according to very strict procedural rules designed in part to protect everybody involved from abuses that might occur if they were conducted hastily or loosely. Another part of the problem is that lawyers have proliferated like lemmings and cultivated a public mentality that encourages those who can afford to to sue at the drop of a hat. All of which creates a steadily growing backlog of cases that makes the whole process even slower and costlier—and therefore less accessible to the moderately wronged person of moderate means.

But help may be on the way.

Consider: legal proceedings consist largely of analyzing data ("evidence" and "testimony") and comparing it to a large body of written law and judicial precedent to determine what should be done in a particular case. It's slow and expensive because the body of law and precedent to be searched is huge and human beings do that sort of work slowly, and meanwhile have to be fed, clothed, and housed. (And need I point out that lawyers, as a group, have become accustomed to being fed, clothed, and housed rather well?)

Now—reread the last paragraph. (You can skip the part in parentheses, if you like.) Sound familiar? "Analyze data and compare to a large body of stored information," hey? Exactly the sort of thing that humans do very slowly and inefficiently—

And computers thrive on!

Lawyers are already beginning to use computers to speed up their research, but I can imagine that line of evolution going much farther. I can envision a court system of the future—perhaps

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even the not too distant future—in which slow, expensive human beings play only a peripheral (pun intended) role. It has far fewer lawyers and judges, and a lot more computer terminals, all connected to an electronic data base containing the entire body of law and precedent. In many cases, only the parties in the case, and perhaps witnesses and an overseer to insure that proper procedures are followed, need be present. Each sits at a terminal and inputs his testimony. (Notice I didn't say "keys in"; there's no reason to assume I/O devices will stay at that level indefinitely.) When the computer has received all input from the parties in the case, it can then analyze that input in the light of everything in the data base—far faster than unaided humans

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could—and prescribe a course of action to be implemented by an appropriate arm of government. Given lots of terminals, memory, and processing capacity, such a system could process so many more cases at once, and process them so much faster than the present system, that it might actually make possible "justice for all": a genuinely speedy, fair trial that practically anyone can afford. It would even have the added benefit of making the outcome of a case depend more on its factual merits than on whose lawyer is the flashier verbal fencer. Of course, not everybody would consider that an advantage, and the system might eventually make people less inclined to attempt some of the more outrageously stupid kinds of suits.

I can hear the howls already: let a *mere machine* do the sacred work of a jury of peers? The flippant or cynical answer might be to suggest that you take a good look at some of those peers and consider carefully whether you'd really rather have your fate decided by them than by a genuinely impartial, well informed, competently programmed machine. A less flippant answer might take a little longer. No, I *don't* claim that any system presently exists which is ready to be trusted with this job. It requires not only a very large storage and processing capacity, but a very sophisticated level of "artificial intelligence." But some impressive strides have already been made in that direction. They will get bigger and faster, and I see no reason to believe that the level and kind of analysis needed for most legal cases requires anything inherently unachievable. The importance of the job is such that the expense of the very best hardware and software will be justified—and in the long run, over all the cases it will be called on to handle, it will still be cheap.

How do you know when a system is adequate? Well, you might give it an extended trial period during which it independently tries the same cases being tried by conventional human courts, and you compare the results. One approach would be to require that its decision match that of the human court almost all the time; when it does, it's good enough to take over. Of course, not all human courts would reach the same conclusion in a given case, so that might not be the best approach. You might instead want to have an independent human "court" judging when the computer is producing *competent* decisions, by human standards, whether or not they're identical to those delivered by any particular human court. Those are details, all of which would have to be thrashed out, with special attention to the possible pitfalls in any proposed approach. The important thing is that *human beings* would decide when the computer system was working enough like a good human court to be trusted with the whole legal process. Even after that, quite probably there would continue to be *some* cases requiring human judges and juries. These might be identified by elements built into the system's software for the express purpose of recognizing problems that go beyond what it's equipped to handle, and flagging those for human attention. But the num-

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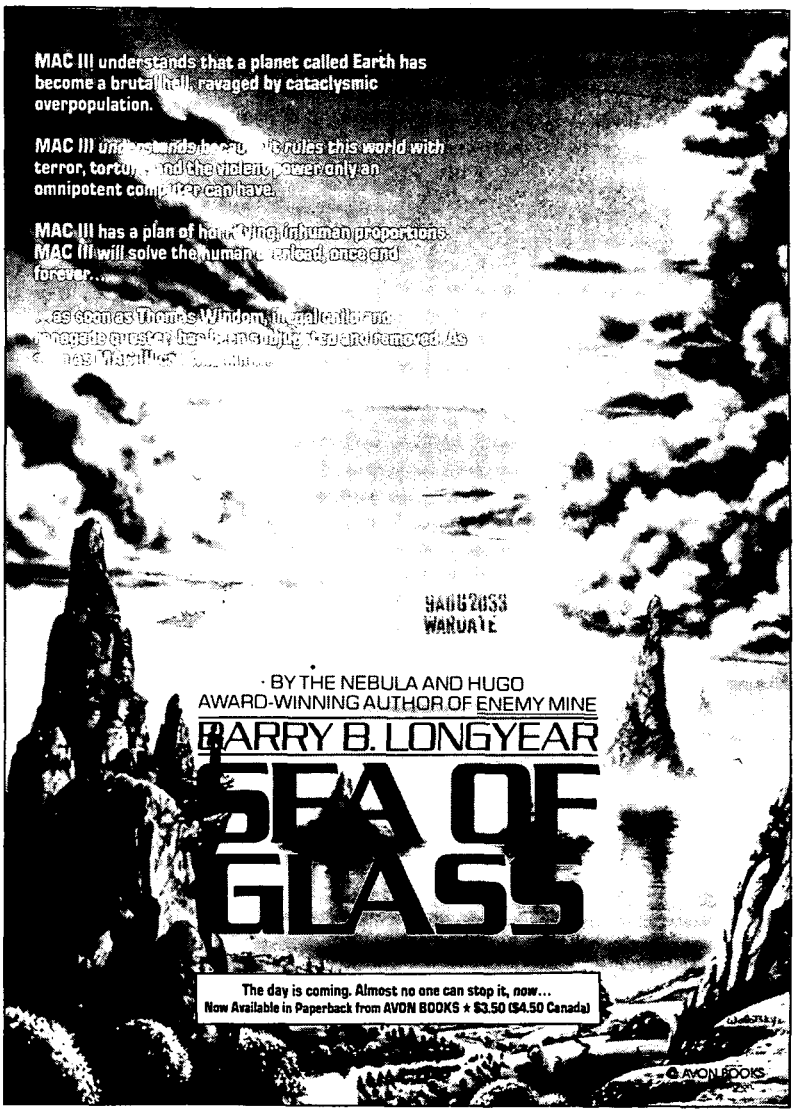
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ber of those should decrease as the system evolves, and eventually it might become very small indeed.

The system would never be absolutely infallible, but neither is the present one. What people need and will eventually accept is a system of justice that they can actually use and that gives what they recognize as justice as much of the time as possible. If a computerized justice system like the one I've described were proposed for adoption right now, even if a fully operational one were available off the shelf and could be proved to give identical results to the traditional system, I have no doubt that it would be loudly and almost unanimously rejected. But I'm not nearly so sure that that will remain true very long.

Much of the automatic hostility to letting "mere machines" do "human" work comes, quite understandably, from older generations to whom the concept is new, unfamiliar, and frightening. In many cases their fear derives largely from ignorance of what computers can and can't actually do—and a tendency to attribute the limitations of our present rather primitive machines to the "machine" part of their nature rather than to the "primitive." But there is a new generation already growing up who are *comfortable* with computers. These people have a more detailed and realistic understanding than their elders of what computers can and can't do; they are more inclined to a matter-of-fact acceptance of them as tools to be used for what they do well—and less inclined to purely emotional fear of them. What kind of society will evolve when members of that generation begin being ripped off by contractors, finding themselves unable to take advantage of the legal recourse they're theoretically entitled to—and wondering whether there's a better way?

After all: would you rather have cheap, accessible, reliably satisfactory justice from a machine *now*—or a vague and unconvincing promise of "human justice" ten years from now (if ever)? ■

● Science, by itself, cannot supply us with an ethic. It can show us how to achieve a given end, and it may show us that some ends cannot be achieved.

Bertrand Russell

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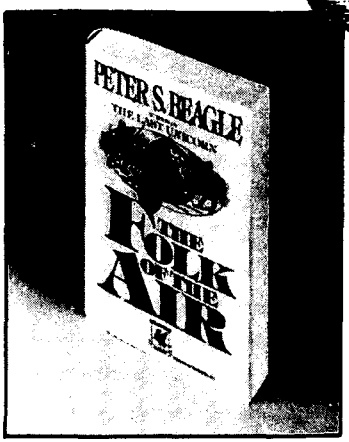

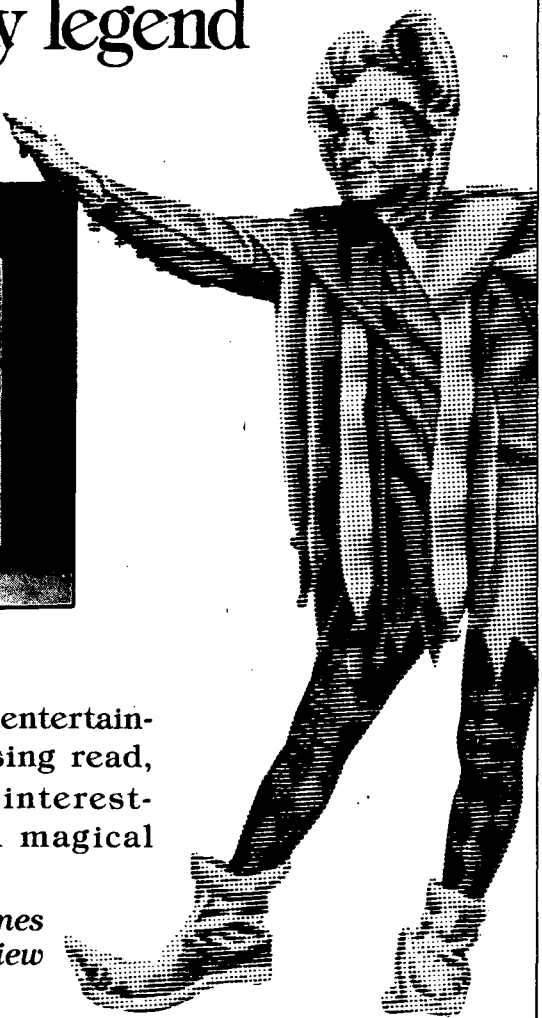

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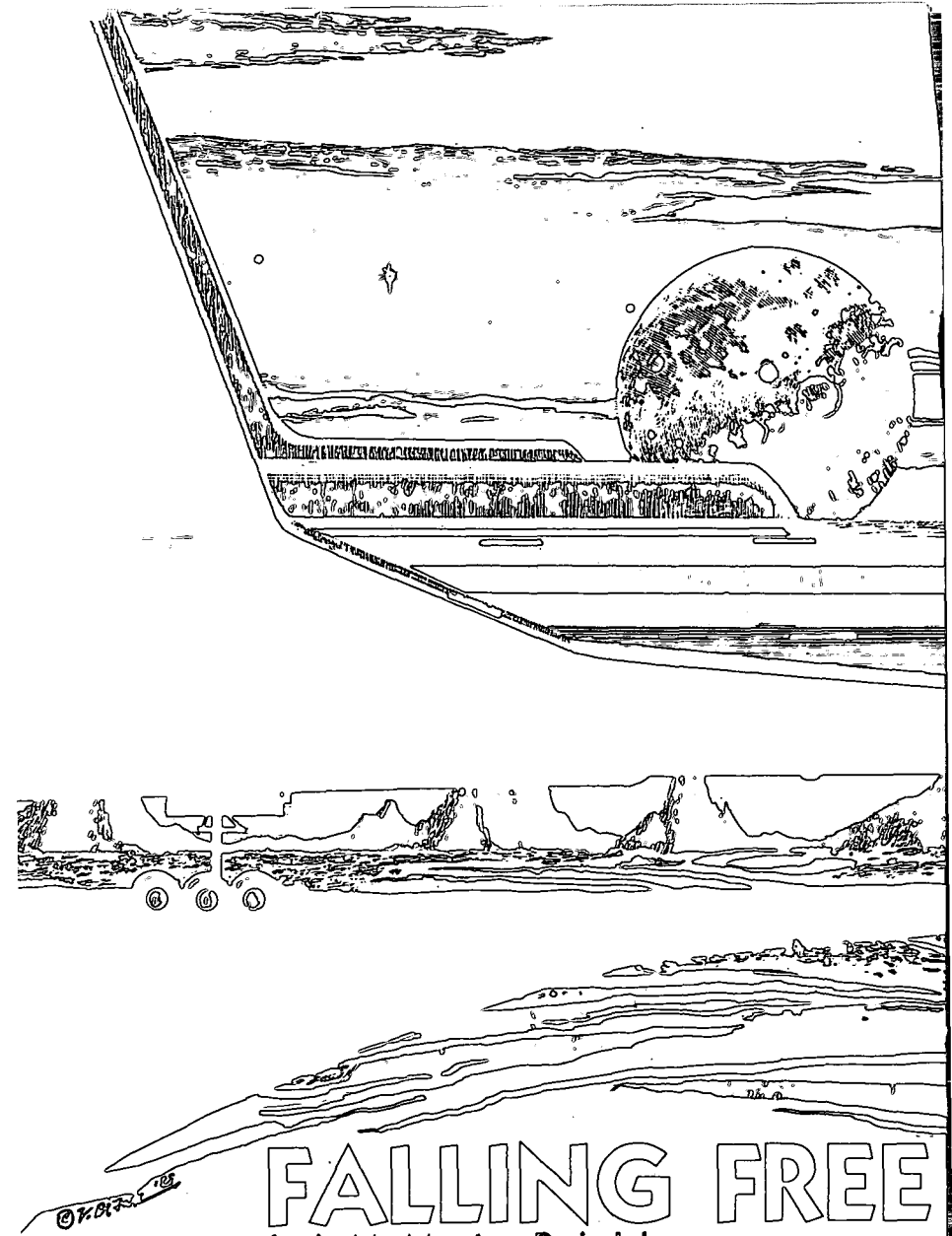

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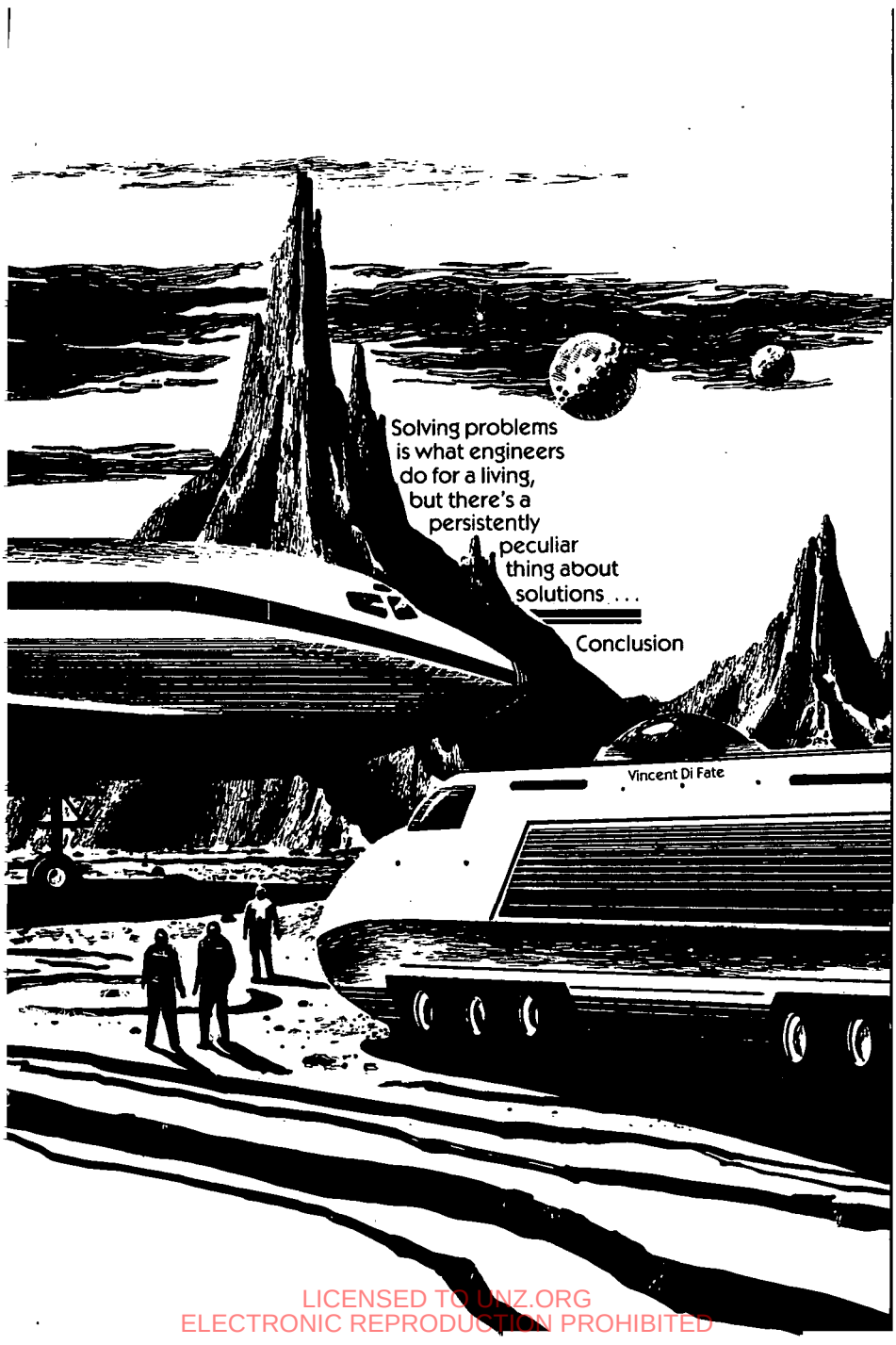
Solving problems is what engineers do for a living, but there's a persistently peculiar thing about solutions . . .
Conclusion
Vincent Di Fate

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Engineer **LEO GRAF** *arrived at the Cay Habitat, a space R&D facility orbiting the planet Rodeo, expecting to teach his short course in advanced welding and non-destructive testing techniques to a class of space workers. But Leo nearly went into shock when his new boss, Chief of Project* **BRUCE VAN ATTA,** *introduced him to his first student,* **TONY.** *The workers were a genetically-engineered new species of human designed to live and work permanently in free fall. In addition to numerous metabolic changes, the most spectacular alteration was the replacement of useless downsider legs with a second set of arms.*

Tony in turn introduced Leo proudly to **CLAIRE,** *his quaddie girlfriend, and their infant son* **ANDY.** *"The workers," Van Atta explained, "are self-replicating," at least after the first generation who were bred in artificial wombs. Leo quickly came to like the four-armed quaddies, but remained uneasy, recognizing that GalacTech was reintroducing slavery in a high-tech guise.*

GalacTech psychologist **DR. SONDRA YEI** *did not relieve Leo's uneasiness by a strict lecture on how to behave so as not to corrupt the carefully-nurtured quaddies with contraband ideas. His struggle to articulate his unease only offended her. Yei's own main worry, based on her keen understanding of the quaddies' total lack of legal rights, was to socialize them so thoroughly that even those persons violently prejudiced against the products of bioengineering could not perceive them as a threat. She had no illusions about the negative outcome for the quaddies of such a confrontation. Quelling his doubts, Leo settled in and began his classes.*

Yet changes were already beginning, despite Yei's care. The careless behavior of Van Atta, above Yei's reach for discipline, was already giving the quaddies an array of ideas and techniques for alternative lifestyles not in the company specs—especially the pretty blonde **SILVER,** *whom Van Atta was using sexually.*

Six weeks after Leo's arrival, Tony and Claire's happy tranquility was shattered. Due to a Habitat-wide drive by Van Atta to increase productivity, Claire was given her new "reproduction assignment" early—scheduled to start a new pregnancy. It didn't include Tony. Tony, rated tops in his class, was slated to depart on assignment to the first deep-space construction project GalacTech had landed for its new quaddie workers. Leo noticed Tony seemed depressed and distracted in class, but stopped short of prying the cause out of the boy.

Later, he wished he had. With the aid of their friend Silver, Tony and Claire planned to escape the Habitat.

Silver, extending lessons learned from her contact with Van Atta, had been trading sex with shuttle pilot **TI GULIK** *in exchange for contraband books and vids. (Silver's taste ran to titles like "Love in the Gazebo," not to be found in the strictly censored company library which was stocked with thrillers like "Cleaning and Maintenance Techniques for Food Service Areas.") For Ti, their affair was a mere diversion while on his enforced gravity leaves from his primary occupation as a Jump-*

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ship pilot. But this time Silver found it an excellent way to distract the pilot while Tony, Claire, and Andy sneaked aboard his freight shuttle bound, they thought, for the orbital transfer station on the other side of the planet. From there they planned to stow away on an outbound Jumpship and escape from GalacTech.

Meanwhile, GalacTech Operations **Vice President APMAD** *arrived early on an inspection tour of the Rodeo mining and drilling facilities and especially of the Cay Habitat. Ti's shuttle was diverted downside to Rodeo Shuttleport Three, to pick up supplies urgently needed for the dog-and-pony show planned at the Habitat for Apmad's benefit. Crippled by gravity, the little refugee family fled the shuttle to hide in an automated freight warehouse at the shuttleport.*

Back at the Habitat, Leo and Yei began a frantic search for their pet students. Leo thought to question Silver first. He had almost convinced her to tell him Tony and Claire's whereabouts when Van Atta and Yei broke in on them. Van Atta's anger frightened Silver, and she clammed up. Van Atta, now utterly infuriated, hauled her off to be questioned under drugs.

CAPTAIN GEORGE BANNERJI, *Shuttleport Three's chief of Security, answered his vid to find Van Atta, clearly laboring under strong emotion: "We have a little problem here, Captain." Bannerji was new on Rodeo; Van Atta's urgent pleas for secrecy in the recapture of the "escaped experimental subjects" thoroughly alarmed the security man. Unnerved, he traded his lightweight Security stunner for an unregistered and lethal pistol. Feeling better, he shrugged his uniform jacket back on and turned to greet his patrolmen reporting for emergency duty.*

In capturing the quaddies Bannerji shot Tony, and was horrified to discover that the "escaped mutant" was ". . . just a crippled kid!" *Leo and the livid Van Atta hurried to the scene of the accident; Vice President Apmad surprised them just as Leo finally decked Van Atta, whom he had come to loathe.*

During Apmad's investigation of the incident she revealed that the quaddies were in danger of being terminated if their marginal profitability could not be proved. The quaddies were listed on company inventory as "post-fetal experimental tissue cultures"—termination meant their either being sterilized and placed in a downside institution, or killed and cremated. Apmad, herself from a mutagen-scarred planet with draconian anti-birth defect practices, secretly favored this but was held in check by her obligation to uphold the bottom line for GalacTech.

Back on the Habitat Claire had been forcibly separated from her baby Andy. Feeling helpless to aid Tony in hospital downside, she attempted suicide by slipping out an airlock. Leo and Silver barely prevented it. The engineer desperately promised to help her.

While still trying to figure out how, Leo encountered a shuttle pilot who relayed a startling rumor: a new, artificially-generated gravity technology had been developed on the outlying planet of Beta Colony, and was just starting to be marketed on the inner worlds. At

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a stroke, the quaddies were rendered technologically obsolete.

Van Atta glumly confirmed the rumor, and revealed that GalacTech had ordered the Cay Project terminated. The quaddies were to be sterilized and placed downside on Rodeo, there to live out their lives in a dismal barracks-camp. Leo went to Dr. Yei, but found no help; she feared death for the quaddies if they resisted. It was up to Leo.

Then Leo saw the solution—"Why, it's an engineering problem after all!" The entire Habitat with all 1,000 quaddies aboard could be broken down and loaded onto a cargo Superjumper, and jumped out of Rodeo local space; their ultimate destination, an asteroid belt far beyond GalacTech's reach.

Leo contacted Silver, and plans were laid in secret for the great escape. They decided to draft Ti for their Jump pilot, who as a result of his involuntary involvement with Claire and Tony's escapade had been fired and was about to be shipped out. Leo gained another advantage by "volunteering" to Van Atta to take on the engineering task of dismantling the Habitat for salvage. Under the cover of drafting quaddie help, Leo disguised his real task of reconfiguring the Habitat into a colony ship. "Let me tell you," Leo, gulping for courage, said to the quaddies, "about the Promised Land. . . ."

Leo and Silver secretly rode a pusher-tug over to the orbital transfer station and "kidnapped" Ti, who came semi-willingly not for love of Silver as Leo expected, but on the promise of getting to keep the Jumpship after the quaddies got to their final destination. They returned to the Habitat only to depart again immediately to go hijack the Superjumper from the distant wormhole jump point. Leo had to remain with the Habitat to run the revolution. He was becoming increasingly conscious of his regard for Silver, although neither had time for love-making in this desperate hour.

Claire and Leo, awaiting the return of Tony with the Habitat's geneticist/physician **DR. MINCHENKO,** *were dismayed when Minchenko came off the shuttle without his patient. Van Atta had ordered Tony kept downside, where all the quaddies were bound in a few weeks.*

Even worse, the extra pusher fuel rods Leo was expecting were not aboard; instead, due to a typographical error in the order, the Habitat had been misshipped some 100 tons of useless gasoline. **PRAMOD,** *another quaddie on Leo's work gang, interrupted with more bad news; clamps Outside, used for parts of the Habitat assembly, had vacuum-welded themselves together over time, meaning disassembly would take longer than planned.*

Claire reported as ordered to the infirmary, only to find that the scheduled sterilizations were starting with her. *She overpowered the obnoxious* **DR. CURRY,** *and escaped to hide in the Habitat.*

Silver and Ti managed, awkwardly but successfully, to hijack the GalacTech Cargo Superjumper D-620. Silver found within herself both the power to act and the temptations of that power, in shooting and wounding the D-620's pilot during the takeover. But for Silver and her quaddie comrades a retreat into childlike powerlessness was a more

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dangerous temptation, one that she had to use all her courage and sense to overcome.

Bruce Van Atta was astonished when a klaxon sounded and Leo Graf announced a "depressurization emergency." The Habitat's downsider staff obediently streamed into the largest lecture module, where their computer escape map told them to go. Van Atta realized quickly that there was something screwy about this emergency—no pressurization drop should be so Habitat-wide—and at first decided with secret delight that Leo had come up with the final solution to the quaddie problem for GalacTech, "accidently" arranging their asphyxiation. Van Atta was enlightened shortly thereafter when the lecture module with all the downsiders within was suddenly cut off from the Habitat and towed off toward the Transfer Station, opposite the Habitat in Rodeo orbit. Van Atta, enraged, swore revenge on Leo.

But Leo's clearance of downsiders from the Habitat was not complete; several stayed at their posts with their quaddies, including Dr. Minchenko and **MAMA NILLA,** *a crèche mother. They refused to leave. Bowing to their determination and his desperate need for help, Leo permitted them to stay.*

Dr. Minchenko would clearly be immensely valuable to the future colony, but he had a price; they must retrieve Madame Minchenko, who was downside on Rodeo. Leaving his volunteers to run things Inside, Leo turned his attention at last to supervising the massive job of reconfiguring the Habitat to fit in the Superjumper's cargo clamps.

CHAPTER THIRTEEN

His fellow refugees gave way before him as Bruce Van Atta stormed out of the boarding tube and into the passenger arrival lounge of Rodeo Shuttleport Three. He had to pause a moment, hands braced on his knees, to overcome a wave of dizziness induced by his abrupt return to planetside gravity. Dizziness and rage.

For several hours, during the ride around Rodeo orbit in the cut-off lecture module, Van Atta had been horribly certain that Graf was intending to murder them all, despite the contrary evidence of the breath masks. If this was war, Graf would never make a good soldier. *Even I know better than to humiliate a man like this, and then leave him alive. You'll be sorry you double-crossed me, Graf; sorrier still you didn't kill me when you had the chance.* He restrained his rage with an effort.

Van Atta had ordered himself aboard the first available shuttle down from a Transfer Station overburdened by the surprise arrival of almost three hundred unexpected bodies. He had not slept in the twenty hours since the detached lecture module's airlock had, with agonizing glitches and delays, finally been married to that of a Station personnel carrier. He and the other Cay Habitat employees had disembarked in disorganized batches from their cramped prison-mobile and had been ferried to the Transfer Station, where yet more time had been wasted.

Information. It had been almost a full day since they had been evicted from the Cay Habitat. He must have information. He boarded a slide tube and

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headed for Shuttleport Three's administration building, with its communications center. Dr. Yei pattered after him, whimpering about something; he paid little attention.

He caught sight of his own wavering reflection in the plexiplastic walls of the tube as he was carried along above the shuttleport tarmac. Haggard. He straightened, and sucked in his gut. It would not do to appear before other administrators looking beaten or weak. The weak went under.

He gazed through his pale image and across the shuttleport laid out below. On the far side of the tarmac at the monorail terminal cargo pods were already starting to pile up. Ah, yes the damned quaddies were a link in that chain, too. A weak link, a broken link, soon to be replaced.

He arrived at the communications center at the same moment as Shuttleport Three's chief administrator, Chalopin. She was trailed by her Security captain, what's-his-name, oh, yes, that idiot Bannerji.

"What the hell is going on here?" Chalopin snapped without preamble. "An accident? Why haven't you requested assistance? They told us to hold all flights—we've got a major production run backed up halfway to the refinery."

"Keep holding it, then. Or call the Transfer Station. Moving your cargo is not my department."

"Oh, yes it is! Orbital cargo marshalling has been under Cay Project aegis for a year."

"*Ex*-perimentally." He frowned, stung. "It may be my department, but it's not my biggest worry right now. Look, lady, I got a full-scale crisis here." He turned to one of the comm controllers. "Can you punch me through to the Cay Habitat at all?"

"They're not answering our calls," said the comm controller doubtfully. "Almost all of the regular telemetry has been cut off."

"Anything. Telescopic sighting, anything."

"I might be able to get a visual off one of the comsats," said the controller. He turned to his panel, muttering. In a few minutes his screen coughed up a distant flat view of the Cay Habitat as seen from synchronous orbit. He stepped up the magnification.

"What are they *doing?*" asked Chalopin, staring.

Van Atta stared too. What insane vandalism was this? The Habitat resembled a complex three dimensional puzzle pulled apart by an idle child. Detached modules seemed carelessly spilled, floating at all angles in space. Tiny silver figures jetted among them. The solar power panels had mysteriously shrunk to a quarter of their normal area. Was Graf embarked on some nutty scheme for fortifying the Habitat against counterattack, perhaps? Well, it would do him no good, Van Atta swore silently.

"Are they . . . preparing for a siege or something?" Dr. Yei asked aloud, evidently following a similar line of thought. "Surely they must realize how futile it would be . . ."

"Who knows what that damn fool Graf thinks?" Van Atta growled. "The man's run mad. There are a dozen ways we can stand off at a distance and knock that installation to bits even without military supplies. Or just wait and starve

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them out. They've trapped themselves. He's not just crazy, he's stupid."

"Maybe," said Yei doubtfully, "they mean to just go on quietly living up there, in orbit. Why not?"

"The hell you say. I'm going to hook them out of there, and double-quick, too. Somehow . . . No bunch of miserable mutants are going to get away with sabotage on *this* scale. Sabotage —theft—terrorism . . ."

"They are not mutants," began Yei, "they are genetically-engineered childr—"

"Mr. Van Atta, sir?" piped up another comm controller. "I have an urgent memo for you listed on my all-points. Can you take it here?" Yei, cut off, spread her hands in frustration.

"Now what?" Van Atta muttered, seating himself before the comm unit.

"It's a recorded message from the manager of the cargo marshalling station out at Jumppoint. I'll put it online," said the tech.

The vaguely familiar face of the Jumppoint station manager wavered into focus before Van Atta. Van Atta had met him perhaps once, early in his stint here. The small Jumppoint station was manned from the Orient IV side, and was under Orient IV's operations division, not Rodeo's. Its employees were regular Union downsiders and did not normally have contact with Rodeo, nor with the quaddies once destined to replace them.

The station manager looked harried. He gabbled through the preliminary ID's, then came abruptly to the meat of his matter; "What the hell is going on with you people, anyway? A crew of mutant freaks just came out of nowhere, kidnapped a Jump pilot, shot another, and hijacked a GalacTech cargo Superjumper. But instead of jumping *out*, they've headed back with it toward Rodeo. When we notified Rodeo Security, they indicated the mutants probably belonged to you. Are there more out there? Are they running wild or something? I want some answers, dammit. I've got a pilot in the infirmary, a terrorized engineer, and a crew on the verge of panic." From the look on his face the station manager was on the verge of panic himself. "Jumppoint Station out!"

"How old is this memo?" said Van Atta rather blankly.

"About," the comm tech checked his monitor, "twelve hours, sir."

"Does he think the hijackers are quaddies? Why wasn't I informed—" Van Atta's eye fell on Bannerji, standing blandly at attention by Chalopin's elbow, "why wasn't I informed of this at once by Security?"

"At the time the incident was first reported, you were unavailable," said the Security captain, devoid of expression. "Since then we've been tracking the D-620, and it's continued to boost straight toward Rodeo. It doesn't answer our calls."

"What are you doing about it?"

"We're monitoring the situation. I have not yet received orders to do anything about it."

"Why not? Where's Norris?" Norris was Operations manager for the entire Rodeo local space area; he ought to be on this thing. True, the Cay Project was not in his chain of command proper, as Van Atta reported directly to company Ops.

"Dr. Norris," said Chalopin, "is

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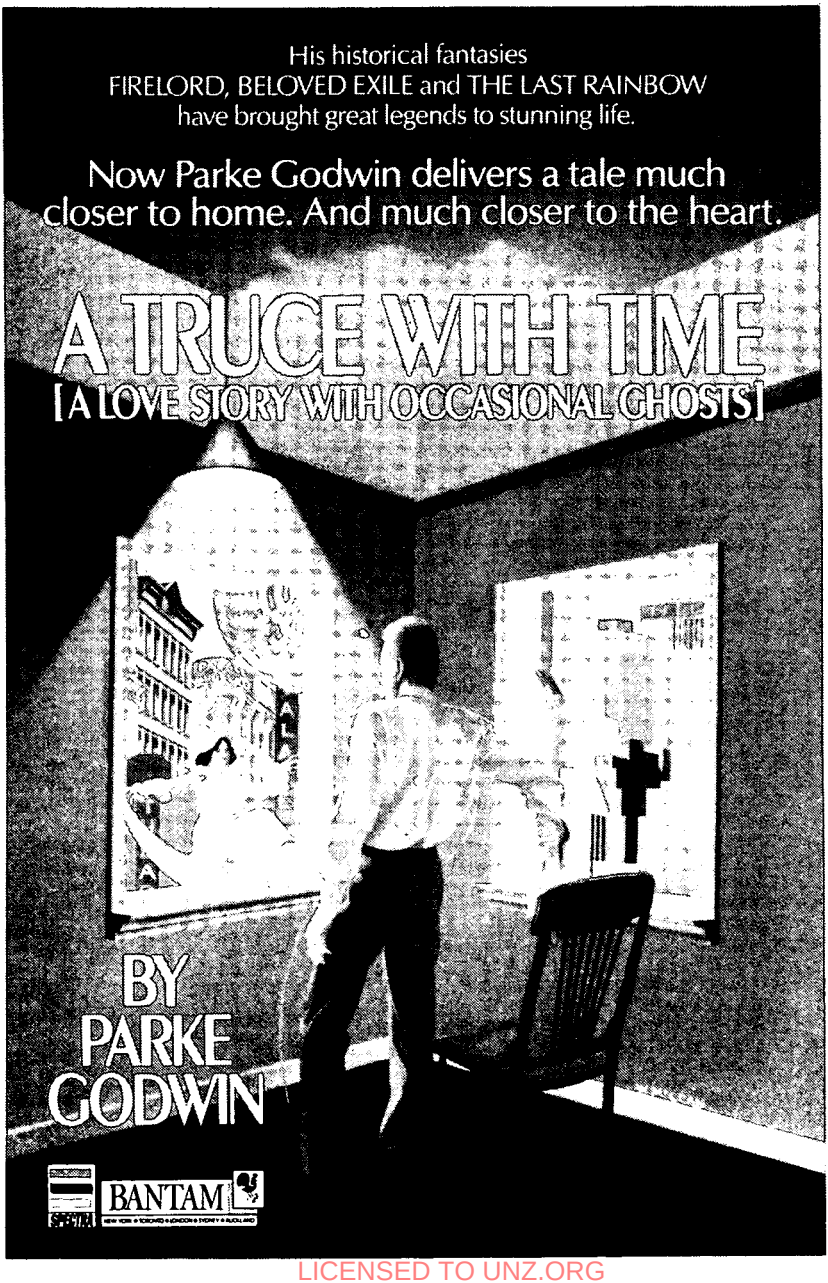
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attending a materials development conference on Earth. In his absence, I am acting Operations manager. Captain Bannerji and I have discussed the possibility of his taking his men and the Shuttleport Three Security and Rescue shuttle and attempting to board the hijacked ship. We're still not sure who these people are or what they want, but they appear to have taken a hostage, compelling caution on our part. So we've let them continue to decrease their range while we *attempt* to gain more information about them. This," she eyed him beadily, "brings us to you, Mr. Van Atta. Is this incident somehow connected to your crisis at the Cay Habitat?"

"I don't see how—" Van Atta began, and broke off, because suddenly he did see how. "Son-of-a-bitch . . ." he whispered.

"Lord Krishna," Dr. Yei said, and wheeled to stare again at the live vid of the Habitat half-dismantled in orbit far above them. "It can't be . . ."

"Graf's crazy. He's crazy, the man's a flaming megalomaniac. He can't *do* this—" the engineering parameters paraded inexorably through Van Atta's mind. Mass—power—distance—yes, a pared-down Habitat, a percentage of its less-essential components dropped, might just barely be torqued by a Superjumper into wormhole space, if it could be wrestled into position at the distant jump point. The whole damn thing . . . "They're hijacking the whole damn thing!" Van Atta cried aloud.

Yei wrung her hands, half-circling the vid. "They'll never manage. They're barely more than children! He'll lead them to their deaths! It's criminal!"

Captain Bannerji and the shuttleport administrator glanced at each other. Bannerji pursed his lips and opened his hand to to her, as if to say, *Ladies first.*

"Do you think the two incidents are connected, then?" Chalopin pressed.

Van Atta too paced back and forth, as if he could so coax an angle from the flat view of the Habitat. ". . . the whole damn thing!"

Yei answered for him, "Yes, we think so."

Van Atta paced on. "Hell, and they've got it apart already! We aren't going to have time to starve 'em out. Got to stop 'em some other way."

"The Cay Project workers were very upset at the abrupt termination of the Project," Yei explained. "They found out about it prematurely. They were afraid of being remaindered downside, being unaccustomed to gravity. I never had a chance to introduce the idea gradually. I think they may actually be trying to—run away, somehow."

Captain Bannerji's eyes widened. He leaned across the console on one hand and stared into the vid. "Consider the lowly snail," he muttered, "who carries its house on its back. On cold rainy days when it goes for a walk, it never has to backtrack. . . ."

Van Atta put an extra half meter of distance between himself and the suddenly poetic Security captain.

"Weapons," Van Atta said. "What kind of weapons does Security have on tap?"

"Stunners," answered Bannerji, straightening up and studying his right thumbnail. Was there a flash of mockery in his eyes? No, he wouldn't dare.

"I mean on your shuttle," said Van

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Atta irritably. "Ship-mounted weapons. Teeth. You can't make a threat without teeth."

"There are two medium-power ship-mounted laser units. Last time we used them was—let me see—to burn through a log snag that had backed up flood waters threatening an exploration camp."

"Yes, well, it's more than *they* have, anyway," said Van Atta excitedly. "We can attack the Habitat—or the Superjumper—either, really. The main thing is to keep them from connecting with each other. Yes, get the Jumpship first. Without it the Habitat is a sitting target we can polish off at our leisure. Is your security shuttle fueled up and ready to go, Bannerji?"

Dr. Yei had paled. "Hold on! Who's talking about attacking anything? We haven't even made verbal contact yet. If the hijackers are indeed quaddies, I'm sure I could persuade them to listen to reason—"

"It's too late for reason. This situation calls for *action*." Van Atta's humiliation burned hot in his stomach, fueled by fear. When the company brass found out how totally he had lost control—well, he'd better be firmly back in control by then.

"Yes, but . . ." Yei licked her lips, "it's all very well to threaten, but the actual use of force is dangerous—maybe destructive—hadn't you better get some kind of authorization first? If something went horribly wrong, you wouldn't want to be left holding the bag, surely."

Van Atta paused. "It would take too much time," he objected at last. "Maybe a day, to reach District HQ on Orient IV and return. And if they decided it was too hot and bounced it all the way to Apmad on Earth, it could be several days before we got a reply."

"But it's going to be several days, isn't it?" said Yei, watching him intently. "Even if they succeed in fitting the Habitat to the Superjumper, they aren't going to be able to swing it around and boost it like a fast courier. It would never stand the strain, it would use too much fuel—there's lots of time yet. Wouldn't it be better to get authorization, to be safe? Then, if anything went wrong—it wouldn't be *your* fault."

"Well . . ." Van Atta slowed still further. How typical, of Yei's wishy-washy, wimpy indecision. He could almost hear her, in his head; *Now, let's all sit down and discuss this like reasonable people*. . . . He loathed letting her push his buttons, still, she had a valid point; cover-your-ass was a fundamental rule for survival even of the fittest.

"Well . . . no, dammit! One thing I can damn well guarantee is that GalacTech is going to want this whole fiasco kept quiet. The last thing they'll want is a lot of rumors flying around about their pet mutants running wild. Better for all of us if this is handled strictly inside Rodeo local space." He turned to Bannerji. "That's the first priority, then—you and your men have got to get that Jumpship back, or at least disable it."

"That," remarked Bannerji to the air, "would be vandalism. Besides, as has been pointed out before—Shuttleport Three Security is not in your chain of command, Mr. Van Atta." He glanced significantly at his boss, who stood listening and pulling worriedly on a strand of hair escaped from her sleek coiffure.

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"True," she agreed. "The Habitat may be your problem, Mr. Van Atta, but this Jumpship hijacking is clearly under my jurisdiction, regardless of their connections. And there's still a cargo shuttle docked up there that's mine, too, though the Transfer Station reported they picked up its crew from a life pod."

Van Atta stood fuming, blocked. Blocked by the damned women. It had been Chalopin's buttons Yei had been aiming for, he realized suddenly, and she'd scored a hit, too. "That's it, then," he said through his teeth at last. "We'll bounce it to HQ. And then we'll see who's in charge here."

Dr.. Yei closed her eyes briefly, as if in relief. At a word from Chalopin a comm tech began readying his system for the relay of a scrambled emergency message to District, to be radioed at the speed of light to the wormhole station, recorded and Jumped through on the next available transport, and radio-relayed again to its destination.

"In the meantime," said Van Atta to Chalopin, "what are you going to do about *your*," he drew the word out sarcastically, "hijacking?"

"Proceed with caution," she replied levelly. "We believe there is a hostage involved, after all."

"We're not sure if all the GalacTech staff is off the Habitat yet, either," put in Dr. Yei.

Van Atta growled, unable to contradict her. But if there were still downsiders being held aboard, senior management must surely realize the need for a swift and vigorous response. He must call the Transfer Station next and get the final head-count. If all these dithering idiots were going to force him to sit on his hands for the next several days, he could at least lay his plans for action when he was unleashed.

And he was certain he would be unleashed, sooner or later. He had not failed to read Apmad's underlying horror of the mutant quaddies. When word of this mess finally arrived on her desk it would goose her three meters straight up in the air, hostages or no hostages —Van Atta's eyes narrowed. "Hey," he said suddenly "we're not as helpless as you think. Two can play that game—*I* have a hostage too!"

"You do?" said Dr. Yei, puzzled. Then her hand went to her throat.

"Damn straight. And to think I almost forgot. That four-armed geek Tony is down here!"

Tony was Graf's teacher's pet—and that little cunt Claire's favorite prick, and *she* was surely a ringleader—if he couldn't swing this to his advantage, he was dead in the head. He spun on his heel. "Come on, Yei! Those little suckers are going to answer our calls now!"

Jump pilots might swear their ships were beautiful, but really, Leo thought as the D-620 hove silently into view, the Superjumper looked like nothing so much as a mutant mechanical squid. A pod-like section at the front end contained the control room and crews quarters, protected from the material hazards encountered during acceleration by an oblate laminated shield and from the hazards of radiation by an invisible magnetic cone. Arcing out behind trailed four enormously long, mutually braced arms. Two housed normal space thrusters, two housed the heart of the ship's

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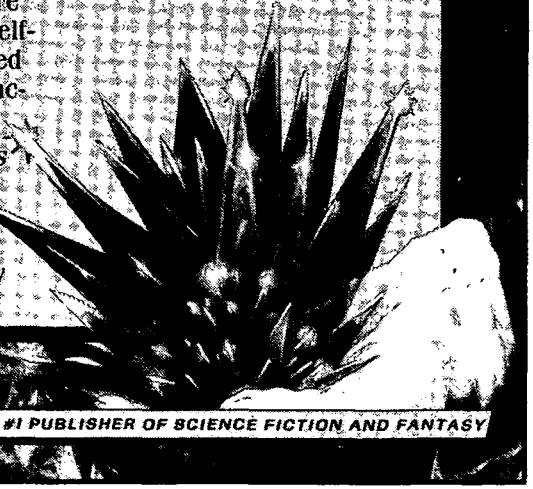

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purpose, the Necklin field generator rods that spun the ship through wormhole space during a jump. Between the four arms was a huge empty space normally occupied by cargo pods. The bizarre ship would look more sensible when that space was filled with Habitat modules, Leo decided. At that point he would even break down and call it beautiful himself.

With a jerk of his chin Leo called up a vid of his worksuit's power and supply levels, displayed on the inside of his faceplate. He would have just time to see the first module bundle pushed into place and attached before being forced to take a break and restock his suit. Not that he hadn't been ready for a break hours ago. He blinked sand and water from his itching, no-doubt-bloodshot eyes, wishing he could rub them, and sucked another mouthful of hot coffee from his drink tube. He wanted fresh coffee, too. The stuff he was drinking now had been out here as long as he had, and was growing just as chemically vile, opaque and greenish.

The D-620 sidled near the Habitat, matching velocities precisely, and shut down its engines. The flight lights blinked out and the parking lights, signalling that it was safe to approach, flicked on. Banks of floods suddenly illuminated the vast cargo space, as if to say, *Welcome Aboard.*

Leo's gaze strayed to the crew's section, dwarfed by the arcing arms. From the corner of his eye he saw a personnel pod peel away from the Superjumper's starboard side and ferry off toward the Habitat modules. Somebody heading home—Silver? Ti? He had to talk to Ti as soon as possible. A previously unrealized knot unwound in his stomach. *Silver's back safe.* He caught himself up; *everybody* was back. But not safe yet. He activated his suit jets and caught up with his quaddie crew.

Thirty minutes later Leo's heart eased as the first module bundle slid smoothly into place in the D-620's embrace. In a minor nightmare, undispelled by checking and rechecking his figures, he'd envisioned something Not Fitting, followed by endless delays for correction. The fact that they'd heard nothing from downside yet, apart from repeated pleas for communication, did not reassure him much. GalacTech management on Rodeo had to respond eventually, and there wasn't a thing he could do to counter that response until it shaped itself. Rodeo's apparent paralysis couldn't last much longer.

Meanwhile, it was half past breaktime. Maybe Dr. Minchenko could be persuaded to disgorge something for his throbbing head, to replace the eight hours sleep he wasn't going to get. Leo punched up his work gang leaders' channel on his suit comm.

"Bobbi, take over as foreman. I'm going Inside. Pramod, bring in your team as soon as that last strap is bolted down. Bobbi, be sure that second module bundle is tied in solid before you adjust and seal all the end airlocks, right?"

"Yes, Leo. I'm on it." Bobbi waved acknowledgment from the far end of the module bundle with a lower arm.

As Leo turned away, one of the one-man mini-pushers that had helped tug the module bundle into place detached itself and rotated, preparing to thrust away and help the next bundle already

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being aligned beyond the Superjumper. One of its attitude jets puffed, then, even as Leo watched, emitted a sudden intense blue stream. Its rotation picked up speed.

That's uncontrolled! Leo thought, his eyes widening. In the bare moment it took him to call up the right channel on his suit comm, the rotation became a spin. The pusher jetted off wildly, missed colliding with a worksuited quaddie by a scant meter. As Leo watched in horror it caroomed off a nacelle on one of the Superjumper's Necklin rod arms and tumbled into space beyond.

The comm channel from the pusher emitted a wordless scream. Leo bounced channels. "Vatel!" he called the quaddie manning the nearest other little pusher. "Go after her!"

The second pusher rotated and sped past him; he saw the flash of one of Vatel's gloved hands visually acknowledging the order through the pusher's wide-angle front viewport. Leo restrained a heart-wrenching urge to jet after them himself. Damn little he could do in a power-depleted worksuit. It was up to Vatel.

Had it been human—or quaddie — error, or a mechanical defect that had caused the accident? Well, he would be able to tell quickly enough once the pusher was retrieved. *If the pusher was retrieved . . .* He squelched that thought. Instead he jetted over to the Necklin rod nacelle.

The nacelle housing was deeply dented where the pusher had collided with it. Leo tried to reassure himself. *It's only a housing. It's put there just to protect the guts from accidents like this, right?* Hissing in dismay, he pulled himself around to shine his worksuit light into the man-high dark aperture at one end of the housing.

Oh, God.

The vortex mirror was cracked. Over three meters wide at its elliptical lip, mathematically shaped and polished to angstrom-unit precision, it was an integral control surface of the Jump system, reflecting, bleeding or amplifying the Necklin field generated by the main rods at the will of the pilot. Not just cracked—shattered in a starry burst, cold titanium deformed past its limits. Leo moaned.

A second light shone in past him. Leo glanced around to find Pramod at his shoulder.

"Is that as bad as it looks?" Pramod's voice choked over the suit comm.

"Yes," sighed Leo.

"You can't—do a welded repair on those, can you?" Pramod's voice was rising. "What are we going to do?"

Fatigue and fear, the worst possible combination—Leo kept his own tired voice flat. "My suit supply level readout says we're going to go Inside and take a break right now. After that we'll see."

To Leo's immense relief, by the time he had unsuited, Vatel had retrieved the errant pusher and brought it back to dock at its Habitat module. They unloaded a frightened, bruised quaddie pilot.

"It locked on, I couldn't get it off," she wept. "What did I hit? Did I hit somebody? I didn't *want* to dump the fuel, it was the only way I could think of to kill the jet. I'm sorry I wasted it. I couldn't shut it off. . . ."

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She was, Leo guessed, all of fourteen years old. "How long have you been on work shift?" he demanded.

"Since we started," she sniffed. She was shaking, all four of her hands trembling, as she hung in air sideways to him. He resisted an urge to straighten her "up."

"Good God, child, that's over twenty-six hours straight. Go take a break. Eat something and go sleep."

She looked at him in bewilderment. "But the dorm units are all cut off and bundled with the crèches. I can't get there from here."

"Is that why. . . ? Look, three-fourths of the Habitat is inaccessible right now. Stake out a corner of the suit locker room or anywhere you can find." He gazed at her tears in bafflement a moment, then added, "It's *allowed*." She clearly wanted her own familiar sleep sack, which Leo was in no position to supply.

"All by myself?" she said in a very small voice.

She'd probably never slept with less than seven other kids in the room in her life, Leo reflected. He took a deep, controlling breath—he would *not* start screaming at her, no matter how wonderfully it would relieve his own feelings—how had he gotten sucked into this children's crusade, anyway? He could not at the moment recall.

"Come along." He took her by the hand off to the locker room, found a laundry bag to hook to the wall, and helped stuff her into it along with a packaged sandwich. Her face peered from the opening, making him feel for a weird moment like a man in the process of drowning a sack of kittens.

"There." He forced a smile. "All better, huh?"

"Thank you, Leo," she sniffed. "I'm sorry about the pusher. And the fuel."

"We'll take care of it." He winked heroically. "Get some sleep, huh? There'll still be plenty of work to do when you wake up, you're not going to miss anything. Uh . . . nighty-night."

" 'Night . . ."

In the corridor he rubbed his hands over his face. "*Nng* . . ."

Three-fourths of the Habitat inaccessible? It was more like nine-tenths by now. And all the module bundles were running on emergency power, waiting to be reattached to the main power supply as they were loaded into the Superjumper. It was vital to the safety and comfort of those trapped aboard various sub-units that the Habitat be fully reconfigured and made operational as swiftly as possible.

Not to mention everyone's having to start to learn their way around a new maze. Multiple compromises had driven the design—crèche units, for example, could go in an interior bundle; docks and locks had to be positioned facing out into space; some garbage vents were unavoidably cut off, power mods had to be positioned just *so*, the nutrition units, now serving some three thousand meals a day, required certain kinds of access to storage. . . . Getting everyone's routines readjusted was going to be an unholy mess for a while, even assuming all the module bundles were loaded in right-side-up and attached head-end-round when Leo wasn't personally supervising—or even when he

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His face was numb.

And now the kicker-question—should they continue loading at all onto a Superjumper that was, just possibly, fatally disabled? The vortex miror, God. Why couldn't she have rammed one of the normal space thruster arms? Why couldn't she have run over Leo himself?

"Leo!" called a familiar male voice.

Floating down the corridor, his arms crossed angrily, came the jump pilot, Ti Gulik. Silver starfished from handgrip to hand-grip behind him, trailed by Pramod. Gulik grabbed a grip and swung to a halt beside Leo. Leo's gaze crossed Silver's in a frustratingly brief and silent *Hello. . . !* before the jump pilot pinned him to the wall.

"What have your damned quaddies done to my Necklin rods?" sputtered Ti. "We go to all this trouble to catch this ship, bring it here, and practically the first thing you do is start smashing it up—I barely got it parked!" His voice faded "Please—tell me that little mutant," he waved at Pramod, "got it wrong. . . ?"

Leo cleared his throat. "One of the pusher attitude jets apparently got stuck in an 'on' position, throwing the pusher into an uncontrollable spin. The term 'unpreventable accident' is not in my vocabulary, but it certainly wasn't the quaddie's fault."

"Huh," said Ti. "Well, at least you're not trying to pin it on the pilot . . . but what was the damage, really?"

"The rod itself wasn't hit—"

Ti let out a relieved breath.

"—but the portside titanium vortex mirror was smashed."

key. "That's just as bad!"

"Calm down! Maybe not quite as bad. I have one or two ideas yet. I wanted to talk to you anyway. When we took over the Habitat, there was a freight shuttle in dock."

Ti eyed him suspiciously. "Lucky you. So?"

"Planning, not luck. Something Silver doesn't know yet—" Leo caught her eye; she braced herself visibly, soberly intent upon his words, "we weren't able to get Tony back before we took over the Habitat. He's still in hospital downside on Rodeo."

"Oh, no," Silver whispered. "Is there any way—?"

Leo rubbed his aching forehead. "Maybe. I'm not sure it's good military thinking—the precedent had to do with sheep, I believe—but I don't think I could live with myself if we didn't at least try to get him back. Dr. Minchenko has also promised to go with us if we can somehow pick up Madame Minchenko. She's downside too."

"Dr. Minchenko stayed?" Silver clapped her hands, clearly thrilled. "Oh, good."

"Only if we retrieve the Madame," Leo cautioned. "So that's two reasons to chance a downside foray. We have a shuttle, we have a pilot—"

"Oh, no," began Ti, "now, wait a minute—"

"—and we desperately need a spare part. If we can locate a vortex mirror in a Rodeo warehouse—"

"You won't," Ti cut in firmly. "Jumpship repairs are handled solely by the District orbital yards at Orient IV. Everything's warehoused on that

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once and had to wait four days for a repair crew to arrive from there. Rodeo's got nothing to do with Superjumpers, nothing." He crossed his arms.

"I was afraid of that," said Leo lowly. "Well, there's one other possibility. We could try to fabricate a new one, here on the spot."

Ti looked like a man sucking on a lemon. "Graf, you don't weld those things together out of scrap iron. I know damn well they make 'em all in one piece—something about joins impeding the field flow—and that sucker's three meters wide at the top end! The thing they stamp them out with weighs multi tons. And the precision required—it would take you six months to put a project like that together!"

Leo gulped, and held up both hands, fingers spread. Had he been a quaddie he might have beene tempted to double the estimate, but, "Ten hours," he said. "Sure, I'd like to have six months. Downside. In a foundry. With a monster alloy-steel press die machined to the milli-micron, just like the big boys. And mass water-cooling, and a team of assistants, and unlimited funding—I'd be all set up to make ten thousand units. But we don't need ten thousand units. There *is* another way. A quick-and-dirty one-shot, but one shot's all we're going to have time for. But I can't be up *here*, refabricating a vortex mirror, and down *there*, rescuing Tony, both at the same time. The quaddies can't go. I need you, Ti. I'd have needed you to pilot the shuttle in any case. Now I'll just need you to do a little more."

"Look, you," Ti began. "Theory was, I was going to get out of this with think I was kidnapped, and had Jumped you out with a gun to my head. A nice simple, believable scenario. This is getting too damned complicated. Even if I could pull off a stunt like that, they're not going to believe I did it under duress. What would keep me from flying downside—and just turning myself in? That's the sort of questions they'll be asking, you can bet your ass. No, dammit. Not for love nor money."

"I know," Leo growled. "We've offered both." Ti glared at him, but ducked his head to evade Silver's eyes.

A thin young voice was echoing down the corridor. "Leo? Leo. . . !"

"Here!" Leo answered. What now . . . ?

One of the younger quaddies swung into sight and darted toward them. "Leo! We've been looking all over for you. Come quick!"

"What is it?"

"An urgent message. On the comm. From downside."

"We're not answering their messages. Total blackout, remember? The less information we give them, the longer it's going to take them to figure out what to do about us."

"But it's Tony!"

Leo's guts knotted, and he lurched after the messenger. Silver, pale, and the others followed hot behind.

The holovid solidified, showing a hospital bed. Tony was braced against the raised backrest, looking directly into the vid. He wore a T-shirt and shorts, a white bandage around his left lower bicep, a thick stiffness to his torso hinting at wrappings beneath. His face was

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His blue eyes shifted nervously, white-rimmed like a frightened pony's, to the right of his bed where Bruce Van Atta stood.

"Took you long enough to answer your call, Graf," Van Atta said, smirking unpleasantly.

Leo swallowed hard. "Hullo, Tony. We haven't forgotten you, up here. Claire and Andy are all right, and back together—"

"You're here to listen, Graf, not talk," Van Atta interrupted. He fiddled with a control. "There, I've just cut your audio, so you can save your breath. All right, Tony," Van Atta prodded the quaddie with a silver-colored rod—what was it? Leo wondered fearfully—"say your piece."

Tony's gaze shifted back, to the silent vid image Leo guessed, and his eyes widened urgently. He took a deep breath and began gabbling, "Whatever you're doing, Leo, keep doing it. Never mind about me. Get Claire away—get Andy away—"

The holovid blacked out abruptly, although the audio channel remained open a moment longer. It emitted a strange spatting noise, a scream, and Van Atta swearing "Hold still, you little shit!" before the sound cut off too.

Leo found himself gripping one of Silver's hands.

"Claire was on her way over," Silver said lowly, "to be in on this call."

Leo's eyes met hers. "I think you'd better go divert her."

Silver nodded grim understanding. "Right." She swung away.

The vid came back up. Tony was huddled silently in the far corner of the Van Atta stood glaring, rocking furiously on his heels.

"The kid's a slow learner, evidently," Van Atta snarled to Leo. "I'll make it short and clear, Graf. You may hold hostages, but if you so much as touch 'em, you can be swung in any court in the galaxy. *I've* got a hostage I can do anything I want to, legally. And if you don't think I will, just try me. Now, we're going to be sending a Security shuttle up there in a little while to restore order. And you *will* cooperate with it." He held up the silvery rod, pressed something; Leo saw an electric spark spit from its tip. "This is a simple device, but I can get real creative with it, if you force me to. Don't force me to, Leo."

"Nobody's forcing you to—" Leo began.

"Ah," Van Atta interrupted, "just a minute. . . ." he touched his holovid control, "now talk so's I can hear you. And it had better be something I want to hear."

"Nobody here can force you to do anything," Leo grated. "Whatever you do, you do of your own free will. We don't have any hostages. What we have is three volunteers, who chose to stay for—for their consciences' sake, I guess."

"If Minchenko's one of them, you'd better watch your back, Leo. Conscience hell, he wants to hang onto his own little empire. You're a fool, Graf. Here—" he made a motion off-vid, "come talk to him in his own language, Yei."

Dr. Yei stepped stiffly into view, met Leo's eyes and moistened her lips. "Mr.

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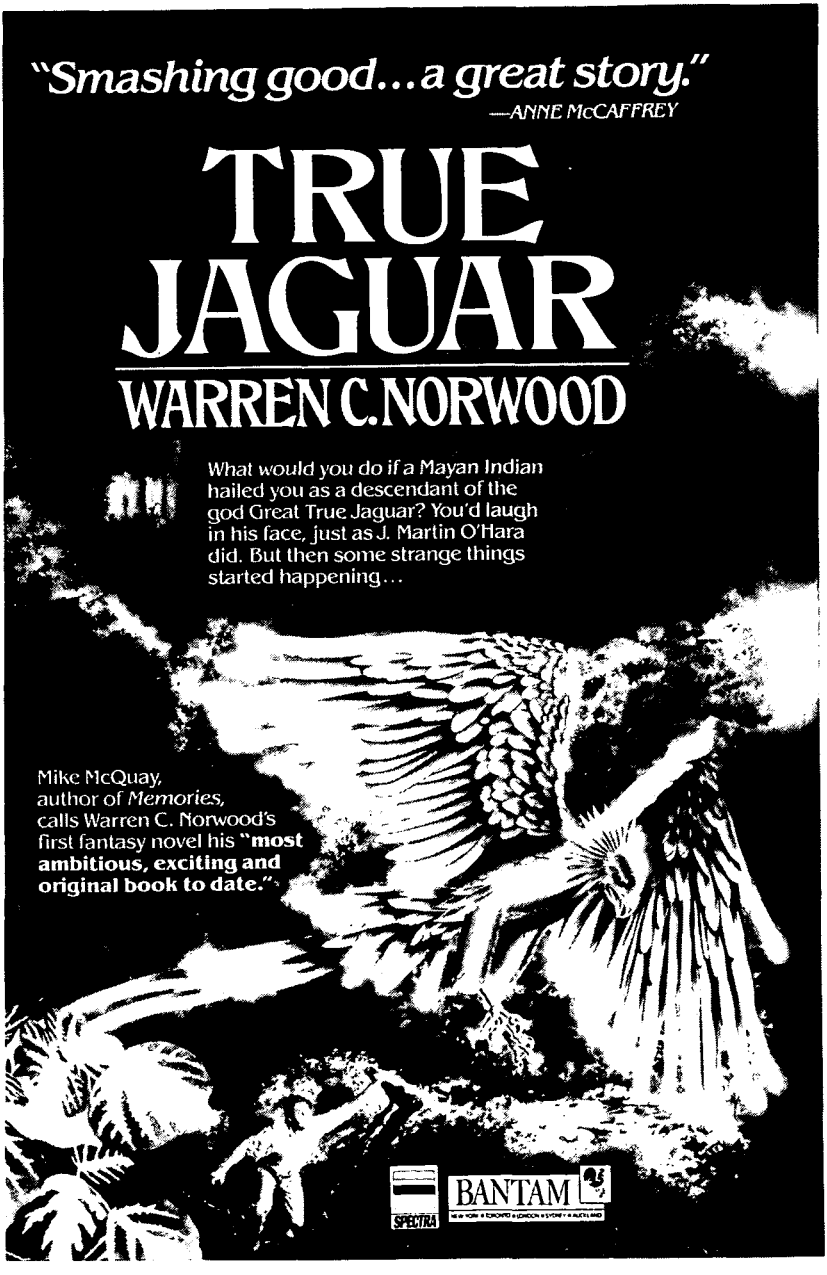
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Graf, please, stop this madness. What you are trying to do is incredibly dangerous, for all concerned—" Van Atta illustrated this by waving the electric prod over her head with a sour grin; she glanced at him in irritation, but said nothing and plowed on grimly, "Surrender now, and the damage can at least be minimized. Please. For everyone's sake. You have the power to stop this."

Leo was silent for a moment, then leaned forward. "Dr. Yei, I'm forty-five thousand kilometers up. You're there in the same room. . . . *you* stop him." He flicked the holovid off, and floated in numb silence.

"Is that wise?" choked Ti uncertainly.

Leo shook his head. "Don't know. But without an audience, there's no reason to carry on a show, surely."

"Was that acting? How far will that guy really go?"

"In the past I've known him to have a pretty uncontrolled temper, when he got wound up. An appeal to his self-interest usually unwound him. But as you've realized yourself, the, um, career rewards in this mess are minimal. I don't know how far he'll go. I don't think even he knows."

After a long pause Ti said, "Do you, ah—still need a shuttle pilot, Leo?"

CHAPTER FOURTEEN

Silver clutched the arms of the shuttle co-pilot's seat tightly in mixed exhilaration and fear. Her lower hands curled over the seat's front edge, seeking purchase. Deceleration and gravity yanked at her. She spared a hand to double-check the latch of the shoulder-harness snuggling her in as the shuttle altered its attitude to nose-down and the ground hove into view. Red desert mountains, rocky and forbidding, wrinkled and buckled below them, passing faster and faster as they dropped closer.

Ti sat beside her in the commander's chair, his hands and feet barely moving the controls in tiny, constant corrections, eyes flicking from readout to readout and then to the real horizon, totally absorbed. The atmosphere roared over the shuttle's skin and the craft rocked violently in some passing wind shear. Silver began to see why Leo, despite his expressed anguish at the risk to them all of losing Ti downside, had not substituted Zara or one of the other pusher pilots in Ti's stead. Even barring the foot pedals, landing on a planet was definitely a discipline apart from jetting about in free fall, especially in a vehicle nearly the size of a Habitat module.

"There's the dry lake bed," Ti nodded forward, addressing her without taking his eyes from his work. "Right on the horizon."

"Will it be—very much harder than landing on a shuttleport runway?" Silver asked in worry.

"No problem," Ti smiled. "If anything, it's easier. It's a big puddle—it's one of our emergency alternate landing sites anyway. Just avoid the gullys at the north end, and we're home free."

"Oh," said Silver, reassured. "I hadn't realized you'd landed out here before."

"Well, I haven't, actually," Ti murmured, "not having had an emergency yet . . ." He sat up more intently, taking a tighter grip on the contols, and Silver decided perhaps she would not

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distract him with further conversation just now.

She peeked around the edge of her seat at Dr. Minchenko, holding down the engineer's station behind them, to see how he was taking all this. His return smile was sardonic, as if to tease her for her anxiety, but she noticed his hand checking his seat straps too.

The ground rushed up from below. Silver was almost sorry they had not, after all, waited for the cover of night to make this landing. At least she wouldn't have been able to see her death coming. She could, of course, close her eyes. She closed her eyes, but opened them again almost immediately. Why miss the last experience of one's life? She was sorry Leo had never made a pass at her. He must suffer from stress accumulation too, surely. Faster and faster . . .

The shuttle bumped, bounced, banged, rocked, and roared out over the flat cracked surface. She was sorry *she* had never made a pass at Leo. Clearly, you could die while waiting for other people to start your life for you. Her seat harness cut across her breasts as deceleration sucked her forward and the rumbling vibration rattled her teeth.

"Not quite as smooth as a runway," Ti shouted, grinning and sparing her a bright glance at last. "But good enough for company work . . ."

All right, so nobody else was gibbering in terror, maybe this was the way a landing was supposed to be. They rolled to a quite demure stop in the middle of nowhere. Toothed carmine mountains ringed an empty horizon. Silence fell.

"Well," said Ti, "here we are. . . ."

He released his harness with a snap and turned to Dr. Minchenko, struggling up out of the engineer's seat. "Now what? Where is she?"

"If you would be good enough," said Dr. Minchenko, "to provide us with an exterior scan . . ."

A view of the horizon scrolled slowly several times through a monitor, as the minutes ticked by in Silver's brain. The gravity, Silver discovered, was not nearly so awful as Claire had described it. It was much like the time spent under acceleration on the way to the wormhole, only very still and without vibration, or like at the Transfer Station only stronger. It would have helped if the design of the seat had matched the design of her body.

"What if Rodeo Traffic Control saw us land?" she said. "What if GalacTech gets here first?"

"It's more frightening to think Traffic Control might have missed us," said Ti. "As for who gets here first—well, Dr. Minchenko?"

"Mm," he said glumly. Then he brightened, leaned forward and froze the scan, and put his finger on a small smudge in the screen, perhaps 15 kilometers distant.

"Dust devil?" said Ti, plainly trying to control his hopes.

The smudge focused. "Land rover," said Dr. Minchenko, smiling in satisfaction. "Oh, *good* girl."

The smudge grew into a boiling vortex of orange dust spun up behind a speeding land rover. Five minutes later the vehicle braked to a halt beside the shuttle's forward hatchway. The figure under the dusty bubble canopy paused to adjust a breath mask, then the bubble

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swung up and the side ramp swung down.

Dr. Minchenko adjusted his own breath mask firmly over his nose and, followed by Ti, rushed down the shuttle stairs to assist the frail, silver-haired woman who was struggling with an assortment of odd-shaped packages. She gave them all up to the men with evident gladness but for a thick black case shaped rather like a spoon which she clutched to her bosom in much the same way, Silver thought, as Claire clutched Andy. Dr. Minchenko shepherded his lady anxiously upward toward the airlock—her knees moved stiffly, on the stairs—and through, where they could at last pull down their masks and speak clearly.

"Are you all right, Warren?" Madame Minchenko asked.

"Perfectly," he assured her.

"I could bring almost nothing—I scarcely knew what to choose."

"Think of the vast amounts of money we shall save on shipping charges, then."

Silver was fascinated by the way gravity gave form to Madame Minchenko's dress. It was a warm, dark fabric with a silver belt at the waist, and hung in soft folds about her booted ankles. The skirt swirled as Madame Minchenko stepped, echoing her agitation.

"It's utter madness. We're too old to become refugees. I had to leave my harpsichord!"

Dr. Minchenko patted her sympathetically on the shoulder. "It wouldn't work in free fall anyway. The little pluckers fall back into place by gravity." His voice cracked with urgency, "But they're trying to kill my quaddies, Ivy!"

"Yes, yes, I understand. . . ." Madame Minchenko twitched a somewhat strained and absent smile at Silver, who hung one-handed from a strap listening. "You must be Silver?"

"Yes, Madame Minchenko," said Silver breathlessly in her most-politest voice. This woman was quite the most aged downsider Silver had ever seen, bar Dr. Minchenko and Dr. Cay himself.

"We must go now, to get Tony," Dr. Minchenko said. "We'll be back as quick as we can drive. Silver will help you, she's very good. Hold the ship!"

The two men hustled back out, and within moments the land rover was boiling off across the barren landscape.

Silver and Madame Minchenko were left regarding each other.

"Well," said Madame Minchenko.

"I'm sorry you had to leave all your things," said Silver diffidently.

"H'm. Well, I can't say I'm sorry to be leaving here." Madame Minchenko's glance around the shuttle's cargo bay took in Rodeo by implication.

They shuffled forward to the pilot's compartment and sat; the monitor scanned the monotonous horizon. Madame Minchenko still clutched her giant spoon suitcase in her lap. Silver hitched herself around in her wrong-shaped seat and tried to imagine what it would be like to be married to someone for more than twice the length of her own life. Had Madame Minchenko been young once? Surely Dr. Minchenko had been old forever. . . .

"However did you come to be married to Dr. Minchenko?" Silver asked.

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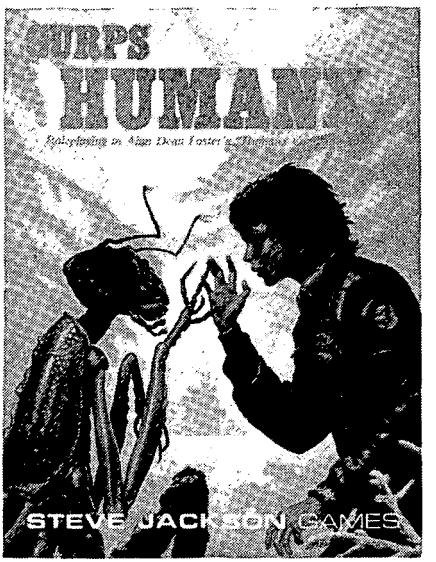

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"Sometimes I wonder," Madame Minchenko murmured dryly, half to herself.

"Were you a nurse, or a lab tech?"

She looked up with a little smile. "No, dear, I was never a bioscientist. Thank God." Her hand caressed the black case. "I'm a musician. Of sorts."

Silver perked with interest. "Synthavids? Do you program? We've had some synthavids in our library, the company library that is."

The corner of Madame Minchenko's mouth twisted up in a half-smile. "There's nothing synthetic in what I do. I'm a registered historian-performer. I keep old skills alive—think of me as a live museum exhibit, somewhat in need of dusting—only a few spider webs clinging to my elbow. . . ." She unlatched her case and opened it to Silver's inspection. Burnished reddish wood, satin-smooth, caught and played back the colored lights of the pilot's compartment. Madame Minchenko lifted the instrument and tucked it under her chin. "It's a violin."

"I've seen pictures of them," Silver offered. "Is it real?"

Madame Minchenko smiled, and drew her bow across the strings in a quick succession of notes. The music ran up and down like—like quaddie children in the gym, was the only simile Silver could think of. The volume was astounding.

"Where do those wires on top attach to the speakers?" Silver inquired, pushing up on her lower hands and craning her neck.

"There were no speakers. The sound all comes from the wood."

"But it filled the compartment!"

Madame Minchenko's smile became almost fierce. "*This* instrument could fill an entire concert hall."

"Do you . . . play concerts?"

"Once, when I was very young—your age, maybe. . . . I went to a school that taught such skills. The only school for music on my planet. A colonial world, you see, not much time for the arts. There was a competition—the winner was to travel to Earth, and have a recording career. Which he subsequently did. But the recording company underwriting the affair was only interested in the very best. *I* came in second. There is room for so very few. . . ." her voice faded in a sigh. "I was left with a pleasing personal accomplishment that no one wanted to listen to. Not when they had only to plug in a disc to hear, not just the best from my world, but the best in the galaxy. Fortunately, I met Warren about then. My permanent patron and audience of one. Probably as well I wasn't trying to make a career of it, we moved so often in those days, when he was finishing school and starting work with GalacTech. I've done some teaching here and there, to interested antiquarians. . . ." She tilted her head at Silver. "And did they teach you any music, with all the things they've been teaching you up on that satellite?"

"We learned some songs when we were little," said Silver shyly. "And then there were the flute-toots. But they didn't last long."

"Flute-toots?"

"Little plastic things you blew in. *They* were real. One of the crèche-mothers brought them up when I was about, oh, eight. But then they sort of got all over the place, people were complaining

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about the, um, tooting. So she had to take them all back."

"I see. Warren never mentioned the *flute-toots*." Madame Minchenko's eyebrows quirked. "Ah . . . what sort of songs?"

"Oh. . . ." Silver drew breath, and sang, "Roy G. Biv, Roy G. Biv, he's the color quaddie that the spectrum gives; Red-orange-yellow, green and blue, indigo, violet, all for you—" she broke off, flushing. Her voice sounded so wavery and weak, compared to that astonishing violin.

"I see," said Madame Minchenko in a strangely choked voice. Her eyes danced, though, so Silver didn't think she was offended. "Oh, Warren," she sighed, "the things you have to answer for. . . ."

"May I," Silver began, and stopped. Surely she would not be permitted to touch that lavish antique. What if she forgot to hold onto it for a moment and the gravity pulled it from her hands?

"Try it?" Madame Minchenko finished her thought. "Why not? We appear to have a little time to kill, here."

"I'm afraid—"

"Tut. Oh, I used to protect this one. It sat unplayed for years, locked up in climate-controlled vaults . . . dead. Then of late I began to wonder what I was saving it for. Here, now. Raise your chin, so; tuck, so," Madame Minchenko curled Silver's fingers around the violin's neck. "What nice long fingers you have, dear. And, er . . . what a *lot* of them. I wonder . . ."

"What?" asked Silver as Madame Minchenko trailed off.

"Hm? Oh. I was just having a mental picture of a quaddie in free fall with a twelve-string guitar. If you weren't squashed into a chair as you are now you could bring that lower hand up . . ."

It was a trick of the light, perhaps, of Rodeo's westering sun sinking toward the sawtoothed horizon and sending its red beams through the cabin windows, but Madame Minchenko's eyes seemed to gleam. "Now arch your fingers, so . . ."

Fire.

The first problem had been to find enough pure scrap titanium around the Habitat to add to the mass of the ruined vortex mirror to allow for the inevitable losses during re-fabrication. A forty percent extra mass margin would have been enough for Leo to feel comfortable with.

There ought to have been titanium storage tanks for nasty corrosive liquids—a single, say, hundred liter tank would have done the trick—conduits, valves, something. For the first desperate hour of scrounging Leo was convinced his plan would come to grief right there in Step One. Then he found it in, of all places, Nutrition; a cooler full of titanium storage canisters massing a good half-kilo apiece. Their varied contents were hastily dumped into every substitute container Leo and his quaddie raiders could find. "Clean-up," Leo had called guiltily over his shoulder to the appalled quaddie girl now running Nutrition, "is left as an exercise for the student."

The second problem had been to find a place to work. Pramod had pointed out one of the abandoned Habitat modules, a cylinder some four meters in diameter. It was the work of another two hours to tear holes in the side for entry

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and pack one end of it with all the conductive scrap metal mass they could find. The mass was then surfaced with more abandoned Habitat module skin, pounded out and rendered as nearly glass-smooth as they could make it in a shallow concave bowl of carefully calculated arc that spanned the diameter of the module.

Now their mass of scrap titanium hung weightless in the center of the module. The broken-up pieces of the vortex mirror and the flattened-out food canisters were all bound together by a spool of pure titanium wire some brilliant quaddie child had produced for them out of Stores. The dense grey metal glittered and glowed in their work-lights and the reflection from a shaft of hard-edged sunlight falling through one of their entry holes.

Leo glanced around the chamber one last time. Four worksuited quaddies each manned a laser unit braced around the walls, bracketing the titanium mass. Leo's measuring instruments floated tethered to his belt, ready to his pressure-gloved hands. It was time. Leo touched his helmet control, darkening his faceplate.

"Commence firing," said Leo into his suit comm.

Four beams of laser light lanced out in unison, pouring into the scrap. For the first few minutes, nothing appeared to be happening. Then it began to glow, dark red, bright red, yellow, white—then, visibly, one of the ex-food canisters began to sag, flowing into the jumble. The quaddies continued to pour in the energy.

The mass was beginning to drift slightly, one of Leo's readouts told him, although the effect was not yet visible to the naked eye. "Unit Four, power-up about ten percent," Leo instructed. One of the quaddies flashed a lower palm in acknowledgement and touched his control box. The drift stopped. Good, his bracketing was working. Leo had had a horrid vision of the molten mass of metal drifting off into the side wall, or worse, fatally brushing into somebody, but the very beams that melted it seemed enough to control its motion, at least in the absence of stronger sources of momentum.

Now the melt was obvious, the metal becoming a white glowing blob of liquid floating in the vacuum, struggling toward the shape of a perfect sphere. *Boy, is that stuff ever going to be pure when we're done*, Leo reflected with satisfaction.

He checked his monitoring devices. Now they were coming up on a moment of critical judgement; when to stop? They must pour in enough energy to achieve an absolutely uniform melt, no funny lumps left in the middle of the gravy. But not too much; even though it was not visible to the eye Leo knew there was metal vapor pouring off that bubble now, part of his calculated loss.

More importantly, looking ahead to the next step—every kilocalorie they dumped into that titanium mass was going to have to be brought back out. Planetside, the shape he was trying to get would have been formed against a copper mold, with lots and lots of water to carry away the heat at the desired rate, in this case rapidly; single-crystal splat-cooling, it was called. Well, at least he'd figured out how to achieve the splat part of it. . . .

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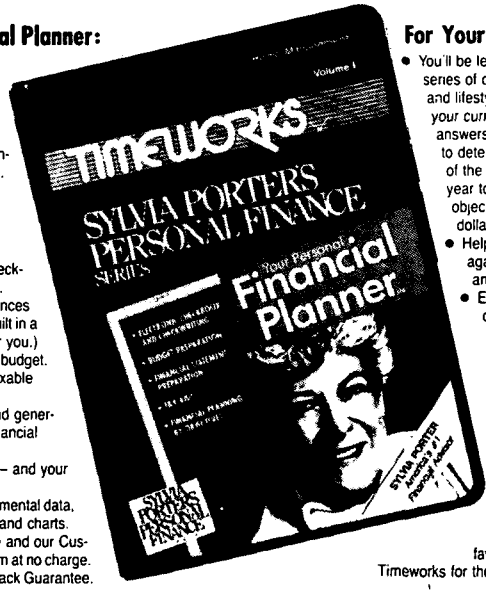

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From America's #1 Financial Adviser

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"Cease firing," Leo ordered.

And there it hung, their sphere of molten metal, blue-white with the violent heat energy contained within it, perfect. Leo checked and rechecked its centered position, and had laser number two give it one more half-second blast not for melt but for momentum's sake.

"All right," said Leo into his suit comm. "Now let's get everything out of this module that's going out, and double check everything that's staying. Last thing we need now is for somebody to drop his wrench in the soup pot, right?"

Leo joined the quaddies in shoving their equipment unceremoniously out the holes torn in the side of the module. Two of his laser operators went with it, two stayed with Leo. Leo checked centering again, and then they all strapped themselves to the walls.

Leo switched channels in his suit comm. "Ready, Zara?" he called.

"Ready, Leo," the quaddie pilot responded from her pusher, now attached to the gutted module's stern.

"Now remember, slow and gentle does it. But firm. Pretend your pusher is a scalpel, and you're just about to operate on one of your friends or something."

"Right, Leo." There was a grin in her voice. *Don't swagger, girl,* Leo prayed inwardly.

"Go when you're ready."

"Going. Hang on up there!"

There was at first no perceivable change. Then Leo's harness straps began to tug gently at him. It was the Habitat module, not the molten ball of titanium, that was moving, Leo reminded himself. The metal did not drift; it was the back wall that moved forward and engulfed it.

It was working, by God it was working! The metal bubble touched the back wall, spread out, and settled into its shallow bowl mold.

"Increase acceleration by the first increment," Leo called into his comm. The pusher powered up, and the molten titanium circle spread, its edges growing toward the desired diameter some three meters wide, already losing its bright glow. Creating a titanium blank of controlled thickness, ready (after cooling) for explosive molding into its final subtle form.

"Steady on. That does it!"

Splat-cooling? Well, not exactly. Leo was uncomfortably aware that they were probably not going to achieve a perfect internal single-crystal freeze. But it would be good, good enough—as long as it was good enough that they didn't have to melt it down and start all over again, that was the most Leo dared pray for. They might, barely, have time to make one of these suckers. Not two. And when *was* the threatened response from Rodeo arriving? Soon, surely.

He wondered briefly what the new gravity technology was going to do to fabrication problems in space like this. Revolutionize seemed too mild a term, certainly. *Too bad we didn't have some now,* he thought. Still—he grinned, concealed within his helmet—they were doing all right.

He pointed his temperature gauge at the back wall. The piece was cooling almost as rapidly as he had hoped. They were still due for a couple of hours of driving around until it had dumped enough heat to remove from the wall

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and handle without danger of deformation.

"All right, Bobbi, I'm leaving you and Zara in charge here," Leo said. "It's looking good. When the temperature drops to about five hundred degrees centigrade, bring it on back. We'll try to be ready for the final cooling and the second phase of the shaping."

Carefully, trying not to add excess vibration to the walls, Leo loosed his harness and climbed to the exit hole. From this distance he had a fine view of the D-620, now more than half-loaded, and Rodeo beyond. Better go now, before the view became more distant than his suit jets could close.

He activated his jets and zipped quickly away from the side of the still-gently-accelerating module-and-pusher unit. It chugged off, looking a drunken, jury-rigged wreck indeed, concealing hope in its heart.

Leo aimed toward the Habitat, and Phase II of his Jumperships-Repaired-While-U-Wait scheme.

It was sunset on the dry lake bed. Silver gazed anxiously into the monitor in the shuttle control cabin as it swept the horizon, brightening and darkening each time the red ball of the sun rolled past.

"They can't possibly be back for at least another hour," Madame Minchenko, watching her, pointed out, "in the best case."

"That's not who I'm looking for," answered Silver.

"Hm." Madame Minchenko drummed her long, age-sculptured fingers on the console, unlatched and tilted back the co-pilot's seat, and stared thoughtfully at the cabin roof. "No, I suppose not. Still—if GalacTech traffic control saw you land and sent out a jet-copter to investigate, they should have been here before now. Perhaps they missed your landing after all."

"Perhaps they're just not very organized," suggested Silver, "and they'll be along any minute."

Madame Minchenko sighed. "All too likely." She regarded Silver, pursing her lips. "And what are you supposed to do in that case?"

"I have a weapon." Silver touched the laser-solderer, lying seductively on the console before the pilot-commander's seat in which she sprawled. "But I'd rather not shoot anybody else. Not if I can help it."

"Anybody *else?*" There was a shade more respect in Madame Minchenko's voice.

Shooting people was such a *stupid* activity, why should everybody—anybody! —be so impressed? Silver wondered irritably. You would think she had done something truly great, like discover a new treatment for black stem-rot. Her mouth tightened.

Then her lips parted, and she leaned forward to stare into the monitor. "Oh, oh. Here comes a ground car."

"Not our boys already, surely," said Madame Minchenko in some unease. "Has something gone wrong, I wonder?"

"It's not your land rover." Silver fiddled with the resolution. The slanting sunlight poured through the dust, turning it into a glowing red smoke screen. "I think . . . it's a GalacTech Security groundcar."

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"Oh, dear." Madame Minchenko sat up straight. "Now what?"

"We don't open the hatches, anyway. No matter what."

In a few minutes the groundcar pulled up about fifty meters from the shuttle. An antenna rose from its roof and quivered demandingly. Silver switched on the comm—it was so irritating, not to have the full use of her lower arms—and called up a menu of the comm channels from the computer. The shuttle seemed to have access to an inordinate number of them. Security audio was 9999. She tuned them in.

"—by God! Hey, you in there—answer!"

"Yes, what do you want?" said Silver.

There was a spluttery pause. "Why didn't you answer?"

"I didn't know you were calling me," Silver answered logically.

"Yeah, well—this freight shuttle is the property of GalacTech."

"So am I. So what?"

"Eh. . . ? Look, lady, this is Sergeant Fors of GalacTech Security. You have to disembark and turn this shuttle over to us."

A voice in the background, not quite sufficiently muffled, inquired, "Hey, Bern—d'you think we'll get the ten percent bonus for recovering stolen property on *this* one?"

"Dream on," growled another voice. "Nobody's gonna give *us* a quarter million."

Madame Minchenko held up a hand, and leaned forward to cut in, quavering, "Young man, this is Ivy Minchenko. My husband, Dr. Minchenko, has commandeered this craft in order to respond to an urgent medical emergency. Not only is this his right, it's his legally compelled duty—and *you* are required by GalacTech regulation to assist, not hinder him."

A somewhat baffled growl greeted this. "I'm required to take this shuttle back. Those are my orders. Nobody told me anything about any medical emergency."

"Well, I'm telling you!"

The background voice again, ". . . it's just a couple of women. Come on!"

The sergeant: "Are you going to open the hatch, lady?"

Silver did not respond. Madame Minchenko raised an inquiring eyebrow, and Silver shook her head silently. Madame Minchenko sighed and nodded.

The sergeant repeated his demands, his voice fraying—he stopped just short, Silver felt, of degenerating into obscenities. After a minute or two he broke off.

After a few more minutes the doors of the ground car winged up and the three men, now wearing breath masks, clambered out to stamp over and stare up at the hatches of the shuttle high over their heads. They returned to the groundcar, got in—it circled. Going away? Silver hoped against hope. No, it came up and parked again under the forward shuttle hatch. Two of the men rummaged in the back for tools, then climbed to the car's roof.

"They've got some kind of cutting things," said Silver in alarm. "They must be going to try to cut their way in."

Banging reverberated through the shuttle.

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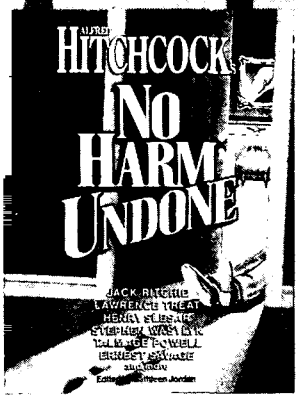

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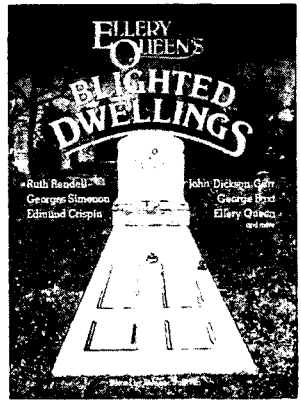

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Madame Minchenko nodded toward the laser-solderer. "Is it time for that?" she asked fearfully.

Silver shook her head unhappily. "No. Not again. Besides, I can't let them damage the ship either—it's got to stay spaceworthy or we can't get home."

She had watched Ti. . . . She inhaled deeply and reached for the shuttle controls. The foot pedals were hopelessly awkward to grope for, she would have to get along without them. Right engine, activate; left engine, activate—a purr ran through the ship. Brakes—there, surely. She pulled the lever gently to the "release" position. Nothing happened.

Then the shuttle lurched forward. Frightened at the abrupt motion, Silver hit the brake lever again and the ship rocked to a halt. She searched the outside monitors wildly. Where—?

The shuttle's starboard airfoil had swept over the roof of the Security groundcar, missing it by half a meter. Silver realized with a guilty shudder that she should have checked its height before she began to move. She might have torn the wing right off, with ghastly chaining consequences to them all.

The Security guards were nowhere to be seen—no, there they were, scattered out onto the dry lake bed. One picked himself up out of the dirt and started back toward the groundcar. Now what? If she parked, or even rolled some distance and parked, they would only try again. It couldn't take too many more attempts till they got smart and shot out the shuttle's tires or otherwise immobilized it. A dangerously unstable standoff.

Silver sucked on her lower lip. Then, leaning forward awkwardly in a seat never designed for quaddies, she released the brakes partway and powered up the port engine. The shuttle shuddered a few meters farther forward, skidding and yawing. Behind them, the monitor showed the groundcar half-obscured by orange dust kicked up by the exhaust, its image wavering in the heat of it.

She set the brakes as hard as they would go and powered up the port engine yet more. Its purr became a whine—she dared not bring it to the howling pitch Ti had used during landing, who knew what would happen then?

The groundcar's plastic canopy cracked in a crazed starburst, and began to sag. If Leo had been right in his description of that hydrocarbon fuel they used downside here for their vehicles, in just a second more she ought to get . . .

A yellow fireball engulfed the groundcar, momentarily brighter than the setting sun. Pieces flew off in all directions, arcing and bouncing fantastically in the gravity field. A glance at her monitors showed Silver the Security men now all running in the other direction.

Silver powered down the port engine, released the brakes, and let the shuttle roll forward across the hard-baked mud. Fortunately, the old lake bed was quite uniform, so she didn't have to worry about the fine points of shuttle operation such as steering.

One of the Security men ran after them for a minute or two, waving his arms, but he fell behind quickly. She

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let the shuttle roll on for a couple of kilometers, braked again, and shut the engines off.

"Well," she sighed, "that takes care of *them*."

"It certainly does," said Madame Minchenko faintly, adjusting the monitor magnification for a last glance behind. A column of black smoke and a dying orange glow in the distant gathering dusk marked their former parking place.

"I hope all their breath masks were well-filled," Silver added.

"Oh, dear," said Madame Minchenko. "Perhaps we ought to go back and . . . do something. Surely they'll have the sense to stay with their car and wait for help, though, and not try to walk off into the desert. The company safety vids always emphasize that. 'Stay with your vehicle and wait for Search and Rescue.' "

"Aren't they supposed to *be* Search and Rescue?" Silver studied the tiny images in the monitor. "Not much vehicle left. But all three seem to be staying there. Well . . ." she shook her head. "It's too dangerous for us to try and pick them up. But when Ti and the Doctor get back with Tony, maybe the security guards could have your land rover to go home in. If, um, nobody else gets here first."

"Oh," said Madame Minchenko, "that's true. Good idea. I feel much better." She peered reflectively into the monitor. "Poor fellows."

Ice.

Leo watched from the sealed control booth overlooking the Habitat freight bay as four worksuited quaddies eased the intact vortex mirror taken from the D-620's second Necklin rod through the hatch from Outside. The mirror was an awkward object to handle, in effect an enormous shallow titanium funnel, three meters in diameter and a centimeter thick at its broad lip, mathematically curved and thickening to about two centimeters at the central, closed dip. A lovely curve, but definitely non-standard, a fact Leo's re-fabrication ploy must needs cope with.

The undamaged mirror was jockeyed into place, nested into a squiggle of freezer coils. The spacesuited quaddies exited. From the control booth, Leo sealed the Outside hatch and set the air to pump back into the loading bay. In his anxiety Leo literally popped out of the control booth, with a woosh of air from the remaining pressure differential, and had to work his jaw to clear his ears.

The only freezer coils big enough to be adequate to the task had been found by Bobbi in a moment of inspiration, once more in Nutrition. The quaddie girl running the department had moaned when she saw Leo and his work gang approach again. They had ruthlessly ripped the guts out of her biggest freezer compartment and carried them off to their work space, in the largest available docking module now installed as part of the D-620. Less than a quarter of the final Habitat reassembly was left to go, Leo estimated, despite the fact that he'd pulled a dozen of the best workers onto this project.

In a few minutes three of his quaddies joined Leo in the freight bay. Leo checked them over. They were bundled up in extra T-shirts and shorts and long-

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sleeved coveralls left by the evicted downsiders, with the legs wrapped tight to their lower arms and secured by elastic bands. They had scrounged enough gloves to go around; good, Leo had been worried about frostbite with all those exposed fingers. His breath smoked in the chilled air.

"All right, Pramod, we're ready to roll. Bring up the water hoses."

Pramod unrolled several lengths of tubing and gave them to the waiting quaddies; another quaddie ran a final check of their connections to the nearest water spigot. Leo switched on the freezer coils and took a hose.

"All right, kids, watch me and I'll show you the trick of it. You must bleed the water slowly onto the cold surfaces, avoiding splash into the air; at the same time you must keep it going constantly enough so that your hoses don't freeze up. If you feel your fingers going numb, take a short break in the next chamber. We don't need any injuries out of this."

Leo turned to the backside of the vortex mirror, nestled among but not touching the freezer coils. The mirror had been in the shade for the last several hours Outside, and was good and cold now. He thumbed his valve and let a silvery blob of water flow onto the mirror's surface. It spread out in swift feathers of ice. He tried some drops on the coils; they froze even faster.

"All right, just like that. Start building up the ice mold around the mirror. Make it as solid as you can, no air pockets. Don't forget to place the little tube to let the air evacuate from the die chamber, later."

"How thick should it be?" asked Pramod, following suit with his hose and watching in fascination as the ice formed.

"At least one meter. At a minimum the mass of the ice must be equal to the mass of the metal. Since we've only got one shot at this, we'll go for at least twice the mass of the metal. We aren't going to be able to recover any of this water, unfortunately. I want to double-check our water reserves, because two meters thick would certainly be better, if we can spare it."

"However did you think of this?" asked Pramod in an awed tone.

Leo snorted, as he realized Pramod had the impression that he was making this entire engineering procedure up out of his head in the heat of the moment. "I didn't invent it. I read about it. It's an old method they used to use for preliminary test designs, before fractal theory was perfected and computer simulations improved to today's standards."

"Oh." Pramod sounded rather disappointed.

Leo grinned. "If you ever have to make a choice between learning and inspiration, boy, choose learning. It works more of the time."

I hope. Critically, Leo drew back and watched his quaddies work. Pramod had two hoses, one in each set of hands, and was rapidly alternating between them, blob after blob of water flowing onto the coils and the mirror, the ice already starting to thicken visibly. So far he hadn't lost a drop. Leo heaved a weary sigh of relief; it seemed he could safely delegate this part of the task. He gave Pramod a high sign, and left the bay to pursue a part of the job he dared not delegate to anyone else.

* * *

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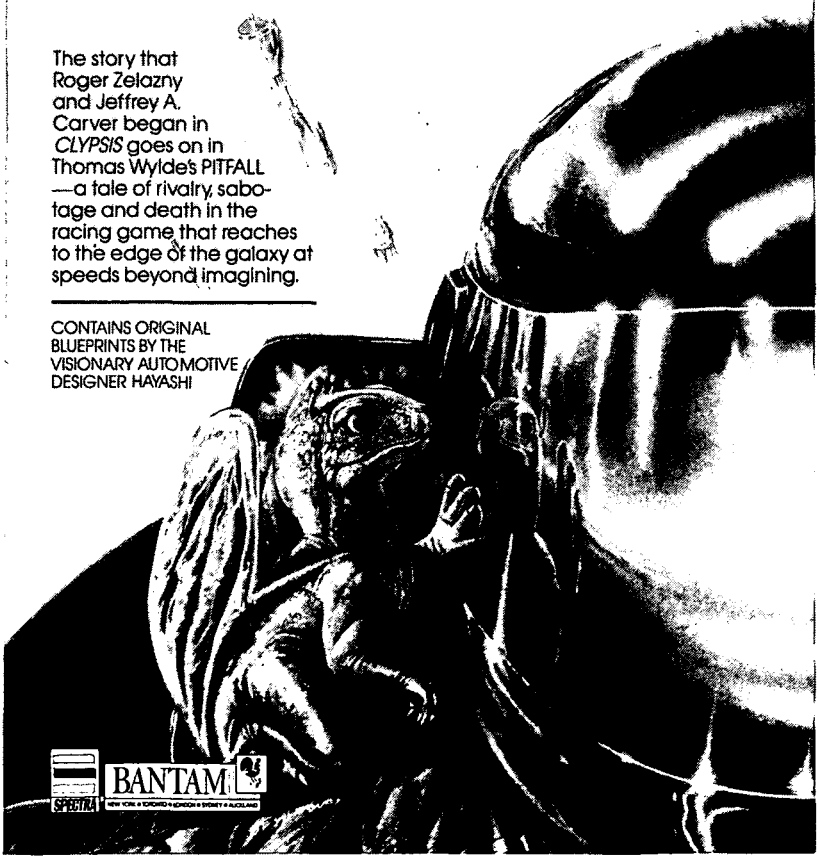

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Leo got lost twice, threading his way through the Habitat to Toxic Stores, and he'd designed the reconfiguration himself. It was no wonder he passed so many bewildered-looking quaddies on the way. Everyone seemed frantically busy; on the principle of misery-loves-company, Leo could only approve.

Toxic stores was a chill module sharing no connections whatsoever with the rest of the Habitat but a triple-chambered and always-closed airlock of thick steel. Leo entered to meet one of his own welding and joining gang quaddies still assigned to Habitat reconfiguration on his way out.

"How's it going, Agba?" Leo asked him.

"Pretty good." Agba looked tired. His tan face and skin were marked with red lines, telltales of recent and prolonged time in his worksuit. "Those stupid frozen clamps were really slowing us up, but we're just about to the end of them. How's your thing going?"

"All right so far. I came in to prepare the explosive, we're that far along. Do you remember where the devil in all this—" the module's curved walls were packed with supplies, "we keep the slurry explosive?"

"It *was* over there," Agba pointed.

"Good—" Leo's stomach shrank suddenly. "What do you mean, *was?*" *He only means it's been moved,* Leo suggested hopefully to himself.

"Well, we've been using it up at a pretty good clip, blowing open clamps."

"Blowing them open? I thought you were cutting them off."

"We were, but then Tabbi figured out how to pack a small charge that cracked them apart on the line of the vacuum fuse. About half the time they're reusable. The other half they're no more ruined than if we'd cut 'em." Agba looked quite proud of himself.

"You haven't used it *all* for that, surely!"

"Well, there was a little spillage. Outside, of course," Agba, misapprehending, added in response to Leo's horrified look. He held out a sealed half-liter flask to Leo's inspection. "This is the last of it. I figure it will just about finish the job."

"Nng!" Leo's snatching hands closed around the bottle and clutched it to his stomach like a man smothering a grenade. "I need that! I have to have it!" *I have to have ten times that much!* his thought howled silently.

"Oh," said Agba. "Sorry." He gave Leo a look of limpid innocence. "Does this mean we have to go back to cutting clamps?"

"Yes," squeaked Leo. "Go," he added. Yes, before he exploded himself.

Agba, with an uncertain smile, ducked back out the airlock. It sealed, leaving Leo alone a moment to hyperventilate in peace.

Think, man, think, Leo told himself. *Don't panic.* There was something, some elusive fact or factor in the back of his mind, trying to tell him this wasn't the end, but he could not at present recall . . . Unfortunately, a careful mental review of his calculations, keeping track on his fingers (oh, to be a quaddie!) only confirmed his initial fear.

The explosive fabrication of the titanium blank into the complex shape of the vortex mirror required, besides an assortment of spacers, rings, and clamps,

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three main parts; the ice die, the metal blank, and the explosive to marry the two. Shotgun wedding indeed. And what is the most important leg of a three-legged stool? The one that is missing, of course. And he'd thought the slurry explosive was going to be the *easy* part . . .

Forlorn, Leo began systematically going around the Toxic Stores module, checking its content. An extra flask of slurry explosive *might* have been misplaced somewhere. Alas, the quaddies were all too conscientious in their inventory control. Each bin contained only what its label proclaimed, no more, no less. Agba had even updated the label on the bin just now; *Contents, Slurry Explosive Type B-2, one-half liter flasks. Quantity, 0.*

About this time Leo stumbled, literally, over a barrel of gasoline. No, some six barrels of the damn stuff, which had somehow washed up here, now strapped firmly to the walls. God knew where the rest of the hundred tons had gone. Leo wished it all in hell, where it might at least be of some conceivable use. He would gladly trade the whole hundred tons of it for four aspirins. A hundred tons of gasoline, of which—

Leo blinked, and let out an "aaah" of exultation.

Of which a liter or so, mixed with tetranitro methane, would make an even *more* powerful explosive.

He would have to look it up, to be sure—he would have to look up the exact proportions in any case—but he was certain he had remembered all right. Learning *and* inspiration, that was the best combination of all. Tetranitro methane was used as an emergency oxygen source in several Habitat and pusher systems. It yielded more O_2 per cc than liquid oxygen, without the temperature and pressure problems of storage, in a highly refined version of the early tetranitro methane candles which, when burned, gave *off* oxygen. Now—oh, God—if only the TNM hadn't all been used up by somebody, to—to blow up balloons for quaddie children or some damn thing—they *had* been losing air during the Habitat reconfiguration. . . .

Pausing only to put the flask back in its bin and arrange a sign on the barrels reading, in large red print, THIS IS LEO GRAF'S GASOLINE. IF ANYONE ELSE TOUCHES IT HE WILL BREAK ALL THEIR ARMS, he raced out of the Toxic Stores module and away to find the nearest working library computer terminal.

CHAPTER FIFTEEN

Twilight lingered on the dry lake bed, the luminous bowl of the sky darkening gradually through a deep turquoise to a star-flecked indigo. Silver found her attention constantly distracted from horizon-scan by the entrancing color changes of the planetary atmosphere seen through the ports. What subtle variety downsiders enjoyed, bands of purple, orange, lemon, green, blue, with cobalt feathers of water vapor melting in the western sky. It was with some regret that Silver switched the scan to infra-red. Its computer-enhanced colors gave clarity to her vision, but seemed crude and garish after the real thing.

At last came the sight her heart desired; a land rover, bouncing over the distant hilly pass and skidding down the

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last rocky slopes, then peeling out over the lake bed at maximum acceleration. Madame Minchenko hurried out of the pilot's compartment to let down the hatch stairs as the land rover roared to a halt beside the shuttle.

Silver clapped all her hands with delight as she saw Ti thump up the ramp, burdened with Tony clinging piggyback just as Leo had carted her at the Transfer Station. *They got him! They got him!* Dr. Minchenko followed close behind.

There was a short argument back at the airlock, Doctor and Madame Minchenko's muffled voices, then Dr. Minchenko galloped back down the stairs to crack a cold flare and stick it to the land rover's roof. It gave off a brilliant green glare. Good, the stranded security guards should have no trouble seeing that beacon, Silver decided with some relief.

Silver scrambled back across to the co-pilot's seat as Ti staggered into the pilot's compartment, dumped Tony into the engineer's seat, and vaulted into the command chair. He yanked his breath mask down around his neck with one hand while switching on controls with the other. "Hey, who's been messing with my ship?"

Silver turned and pulled herself up to look over the top of her seat at Tony, who had rid himself of his own breath mask and was trying to get his seat straps in order. "You made it!" she grinned.

He grinned back. " 'ust barry. 'Er right behin' us." His blue eyes, Silver realized, were huge with pain as well as excitement, his lips swollen.

"What happened to you—?" Silver turned to Ti. "What happened to Tony?"

"That shit Van Atta burned him in the mouth with his damn cattle prod, or whatever the hell that thing was he had," said Ti grimly, his hands dancing over the controls. The engines came alive, lights flickered, and the shuttle began to roll. Ti hit his intercom. "Dr. Minchenko? You folks strapped down back there yet?"

"Just a moment—" came Dr. Minchenko's reply. "There. Yes, go!"

"Did you have any trouble?" asked Silver, sliding back into her seat and groping for her own straps as the shuttle taxied.

"Not at first. We got to the hospital all right, walked right in with no problem. I thought sure the nurses were going to question our taking Tony, but evidently they all think Minchenko is God, there. We just blasted right through and were on our way out, with me playing donkey—that's all I am, just transportation, y'know?—when who should we meet, going out the door, but that son-of-a-bitch Van Atta coming in."

Silver gasped.

"We tripped him up—Dr. Minchenko wanted to stop and beat the shit out of him, on account of Tony's mouth, but he would have had to delegate the most of it to me—he *is* an old man, little though he wants to admit it—I dragged him out to the land rover. I last heard Van Atta running off screaming for a security jetcopter. He's surely found one by now. . . ." Ti scanned the monitors nervously. "Yes. Damn. There," he pointed. A colorized flare swooped over the mountains, marking the follow-

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ing 'copter's position in the monitor. "Well, they can't catch us now."

The shuttle rocked in a wide circle, then halted; the engines' pitch rose from purr to whine to scream. Its white landing lights tunneled the darkness in front of them. Ti released the brakes and the ship sprang forward, gobbling up the light, with a terrifying noisy rumble that ceased abruptly as they rotated into the air. The acceleration shoved them all back in their seats.

"What the *hell* does that idiot think he's doing?" Ti muttered through his teeth as the jetcopter grew rapidly in the tracking monitor. "Try to play chicken with *me*, will you. . . ?"

It was swiftly apparent that was exactly the jetcopter's intent. It arced toward them, diving as they rose, evidently with some idea of forcing them down. Ti's mouth thinned to a white line, his eyes blazing, and he powered his ship up further. Silver gritted her teeth, but kept her eyes open.

They passed close enough to see the 'copter out the ports, whipping in a strobe-like flash through their lights. In the blink Silver could see faces through the bubble canopy, frozen white blurs with dark round holes of eyes and mouths, but for one individual, possibly the pilot, who had his hands pressed over his eyes.

Then there was nothing between them and the silver stars.

Fire and ice.

Leo rechecked the tightness of every C-clamp personally, then jetted back a few meters in his worksuit to give his efforts one last visual inspection. They floated in space a safe kilometer's distance from the D-620-Habitat configuration, which hung huge and complete now above Rodeo's arc. Anyway, it looked complete on the outside, as long as you didn't know too much about the hysterical last-minute tie-downs still going on within.

The ice die, when finished, had turned out over three meters wide and nearly two meters thick. Its outer surface was irregular; it might have been a tumbling bit of space debris from some gas giant's ice ring. Its secret inner side precisely duplicated the smooth curve of the vortex mirror that had molded it.

The evacuated inner chamber was capped by layers. First, the titanium blank; next, a layer of pure gasoline for a spacer—a handy second use Leo had found for it, unlike other possible liquids it would not freeze at the ice's present temperature—then the thin plastic divider circle, then his precious TNM-gasoline explosive, then a cap of scrap Habitat skin, then the bars and clamps—all in all, quite a birthday cake. Time to light the candle and make his wish come true, before the ice die began to sublimate in the sunlight.

Leo turned to motion his quaddie helpers to get behind the protective barrier of one of the abandoned Habitat modules floating nearby. Another quaddie, he saw, was just jetting over from the D-620-Habitat configuration. Leo waited a moment, to give him or her time to come up and get behind their shelter. Not a messenger, surely, he had his suit comm for that . . .

"Hai, Leo," said Tony's voice thickly through the suit comm. "Sorry I'm lae' for work—d'you leave any for me?"

"Tony!"

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It wasn't easy, trying to embrace someone through a worksuit, but Leo did his best. "Hey, hey, you're just in time for the best part, boy!" said Leo excitedly. "I saw the shuttle dock a bit ago." Yes, and a horrid turn it had given him for a moment, thinking it was Van Atta's threatened Security force at last, until he'd correctly identified it as theirs. "Didn't think Dr. Minchenko'd let you go anywhere but the infirmary. Is Silver all right? Shouldn't you be resting?"

"She's fine. Dr. Minchenko had a lot t'do, 'n Claire 'n Andy's asleep—I looked in—didn't want to wake the baby."

"You sure you're feeling all right, son? Your voice sounds funny."

"Hurt mah mout'. S'all right."

"Ah." Briefly, Leo explained the task in progress. "You've arrived for the grand finale."

Leo jockeyed his suit around until he could just see over the abandoned module. "What we've got out there, in that box on top—the cherry-bomb on the icing, as it were—is a charge capacitor with a couple thousand volts stored in it. Leads down into filament placed in the liquid explosive—I used an incandescent light bulb filament with the polyglass envelope knocked off—that thing sticking up is an electric eye swiped from a door control. When we hit it with a burst from this optical laser, it closes the switch—"

"And the 'lectricity sets the ex'losive off?"

"Not exactly. The high voltage pouring through the filament literally explodes the wire, and it's the shock wave from the exploding wire that sets off the TNM and gasoline. Which blows the titanium blank out until it hits the ice die and transfers its momentum, whereupon the titanium stops and the ice, ah, carries the momentum away. Quite spectacularly, which is why we're behind this module . . ." he turned to check his quaddie crew. "Everybody ready?"

"If you can stick your head up and watch, why can't we?" complained Pramod.

"I have to have line-of-sight for the laser," said Leo primly.

Leo aimed the optical laser carefully, and paused a moment for the anxiety rush. So many things could go wrong—he'd checked and rechecked—but there comes a time when one must let all the doubts go and commit to action. He gave himself up to God and pressed the button.

A brilliant, soundless flash, a cloud of boiling vapor, and the ice die exploded, shards flying off in all directions. The effect was utterly enchanting. With an effort Leo tore his gaze away and ducked hastily back behind the module. The afterimage danced across his retinas, teal green and magenta. His pressure-gloved hand, resting against the module's skin, transmitted sharp vibrations as a few high-speed ice cubes pelted against the other side and ricocheted off into space.

Leo remained hunkered a moment, staring rather blankly at Rodeo. "*Now* I'm afraid to look."

Pramod jetted around the module. "It's all in one piece, anyway. It's tumbling—hard to see the exact shape."

Leo inhaled. "Let's go catch it, kids. And see what we've got."

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It was the work of a few minutes to capture the work piece. Leo refused to let himself call it "the vortex mirror" just yet—it might still turn out to be scrap metal. The quaddies ran their various scanners over the curving grey surface.

"I can't find any cracks, Leo," said Pramod breathlessly. "It's a few millimeters over-thick in spots, but nowhere too thin."

"Thick we can take care of during the final laser-polish. Thin we can't remedy. I'll take thick," said Leo.

Bobbi waved her optical laser, crossing and recrossing the curved surface, numbers blurring in her digital readout. "It's in spec! Leo, it's within spec! We did it!"

Leo's innards were melting wax. He breathed a long and very tired sigh of happiness. "All rights, kids, let's take it Indoors. Back to the—the—darn it, we can't keep calling it the 'D-620-Habitat-Reconfiguration.' "

"Ah sure can't," agreed Tony.

"So what are we going to name it?" An assortment of possibilities flitted through Leo's mind—*the Ark—the Freedom Star—Graf's Folly*. . . .

"Home," said Tony simply after a moment. "Let's go home, Leo."

"Home." Leo rolled the name in his mouth. It tasted good. It tasted very good. Pramod nodded, and one of Bobbi's upper hands touched her helmet in salute of the choice.

Leo blinked. Some irritating vapor in his suit's air was making his eyes water, no doubt, and tightening his chest. "Yeah. Let's take our vortex mirror home, gang."

* * *

Bruce Van Atta paused in the corridor outside Chalopin's office at Shuttleport Three, to catch his breath and control his trembling. He had a stitch in his side, too. He wouldn't be the least surprised if he were developing an ulcer out of all this. The fiasco out on the dry lake bed had been infuriating. To pave the way, and then have fumbling subordinates totally fail him—utterly infuriating.

Sheer chance, that having returned to his own downside quarters for a much-needed shower and some sleep, he'd awakened to take a piss and called Shuttleport Three to check progress. They might not even have told him about the shuttle landing otherwise! Anticipating Graf's next move, he had flung on his clothes and rushed to the hospital—if he'd been moments sooner, he might have trapped Minchenko within.

He had already chewed out the jet-copter pilot, reamed his ass for his cowardice in failing to force down the launching shuttle, for his dilatory failure to arrive at the lake bed faster. The red-faced pilot had clamped his jaw and his fists and said nothing, doubtless properly ashamed of himself. But the real failure lay higher up—on the other side of these very office doors. He jabbed the control, and they slid aside.

Chalopin, her security captain Bannerji, and Dr. Yei had their heads together around Chalopin's computer vid display. Captain Bannerji had his finger on it, and was saying to Yei, ". . . can get in here. But how *much* resistance, d'you think?"

"You'll surely frighten them very much," said Yei.

"Hm. I'm not crazy about asking my

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men to go up with stunners against desperate folk with much more lethal weapons. What *is* the real status of those so-called hostages?"

"Thanks to you," snarled Van Atta, "the hostage ratio is now five to zero. They got away with Tony, damn them. Why didn't you put a twenty-seven-hour guard on that quaddie like I told you? We should have put a guard on Madame Minchenko, too."

Chalopin's head came up, and she gave him an expressionless stare. "Mr. Van Atta, you seem to be laboring under some misconceptions about the size of my security forces here. I have only ten men, to cover three shifts, seven days a week."

"Plus ten each from the other two shuttleports. That's thirty. Properly armed, they'd be a substantial strike force."

"I've already borrowed six men from the other two 'ports to cover our own routine, while my entire force is devoted to this emergency."

"Why haven't you stripped them all?"

"Mr. Van Atta, Rodeo Ops is a big company—but a very small town. There are not ten thousand employees here altogether, plus an equal number of dependents also not employed by GalacTech. My Security is a police force, not a military one. They have to cover their own duties, double for emergency squad and search and rescue, and be ready to assist Fire Control."

"Dammit—I drove a wedge for you with Tony. Why didn't you follow up immediately and board the Habitat?"

"I had a force of eight ready to go up to orbit," said Chalopin tartly, "upon your assurance of cooperation from your quaddies. We were not, however, able to get any confirmation of that cooperation from the Habitat itself. They went right back to maintaining comm silence. Then we spotted our freight shuttle returning, so we diverted the forces to capture it—first a ground car, and then, as you yourself came howling in here demanding not two hours ago, a jetcopter."

"Well, get them back together and get them into orbit, dammit!"

"For one thing, *you* left three of them out on the lake bed," remarked Captain Bannerji. "Sergeant Fors just reported in—says their groundcar was disabled. They're returning in Dr. Minchenko's abandoned land rover. It'll be at least another hour before they're back. For another, as Dr. Yei has several times pointed out, we have not yet received authorization to use any kind of deadly force."

"Surely you've got some kind of hot pursuit clause," argued Van Atta. "*That,*" he pointed upward, indicating the events now going on in Rodeo orbit, "is grand theft in progress at the very least. And don't forget, a GalacTech employee has already been shot by them!"

"I haven't overlooked that fact," murmured Bannerji.

"But," Dr. Yei put in, "having asked HQ for authorization to use force, we are now obliged to wait for their reply. What, after all, if they deny the request?"

Van Atta frowned at her, his eyes narrowing. "I knew we should never have asked. You maneuvered us into that, damn you. They'd have swallowed

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any fait accompli we presented, and been glad of it. Now . . ." he shook his head in frustration. "Anyway, you're overlooking other sources of personnel. The Habitat staff itself can be used to follow up the opening Security drives into the Habitat."

"They're scattered all over Rodeo by now," Dr. Yei remarked, "back to their downside leave quarters, most of them."

Bannerji cringed visibly. "And do you have any idea the kind of legal liability that situation would present to Security?"

"So deputize 'em—"

A beeping from Chalopin's desk console interrupted Van Atta; a comm tech's face appeared in the vid.

"Administrator Chalopin? Comm Center here. You asked us to advise you of any change in the status of the Habitat or the D-620. They, um—appear to be preparing to leave orbit."

"Put it on up here," Chalopin ordered.

The comm tech produced the flat view from the satellite again. He upped the magnification, and the Habitat-D-620 configuration half-filled the vid. The D-620's two normal-space thruster arms had been augmented by four of the big thruster units the quaddies used to break cargo bundles out of orbit. Even as Van Atta watched in horror, the array of engines flared into life. Stirring a glittering array of space trash in its wake, the monstrous vehicle began to move.

Dr. Yei stood staring open-mouthed, her hands clapped to her chest, her eyes glistening strangely. Van Atta felt like weeping with rage himself.

"You see—" he pointed, his voice cracking, "you see what all this interminable dithering has resulted in? They're getting *away!*"

"Oh, not yet," purred Dr. Yei. "It will be at least a couple of days before they can possibly arrive at the wormhole. There is no just cause for panic." She blinked at Van Atta, went on in an almost hypnotically cloying voice, "You are extremely fatigued, of course, as are we all. Fatigue invites mistakes in judgment. You should rest—get some sleep. . . ."

His hands twitched; he burned to strangle her on the spot. The shuttleport administrator and that idiot Bannerji were nodding, reasonable agreement. A choked growl steamed from Van Atta's throat. "Every minute you wait is going to complicate our logistics—increase the range—increase the risk—"

They all had the same bland stare on their faces. Van Atta didn't need his nose rubbed in it—he could recognize concerted noncooperation when he smelled it. Damn, damn, damn! He glowered suspiciously at Yei. But his hands were tied, his authority undercut by her sweet reason. If Yei and all her ilk had their way, nobody would ever shoot anybody, and chaos would rule the universe.

He snarled inarticulately, wheeled on his heel, and stalked out.

Claire woke without yet opening her eyes, snugged in her sleep sack. The exhaustion that had drenched her at the end of last shift was slow to ebb from her limbs. She could not hear Andy stirring yet; good, a brief respite before diaper change. In ten minutes she would

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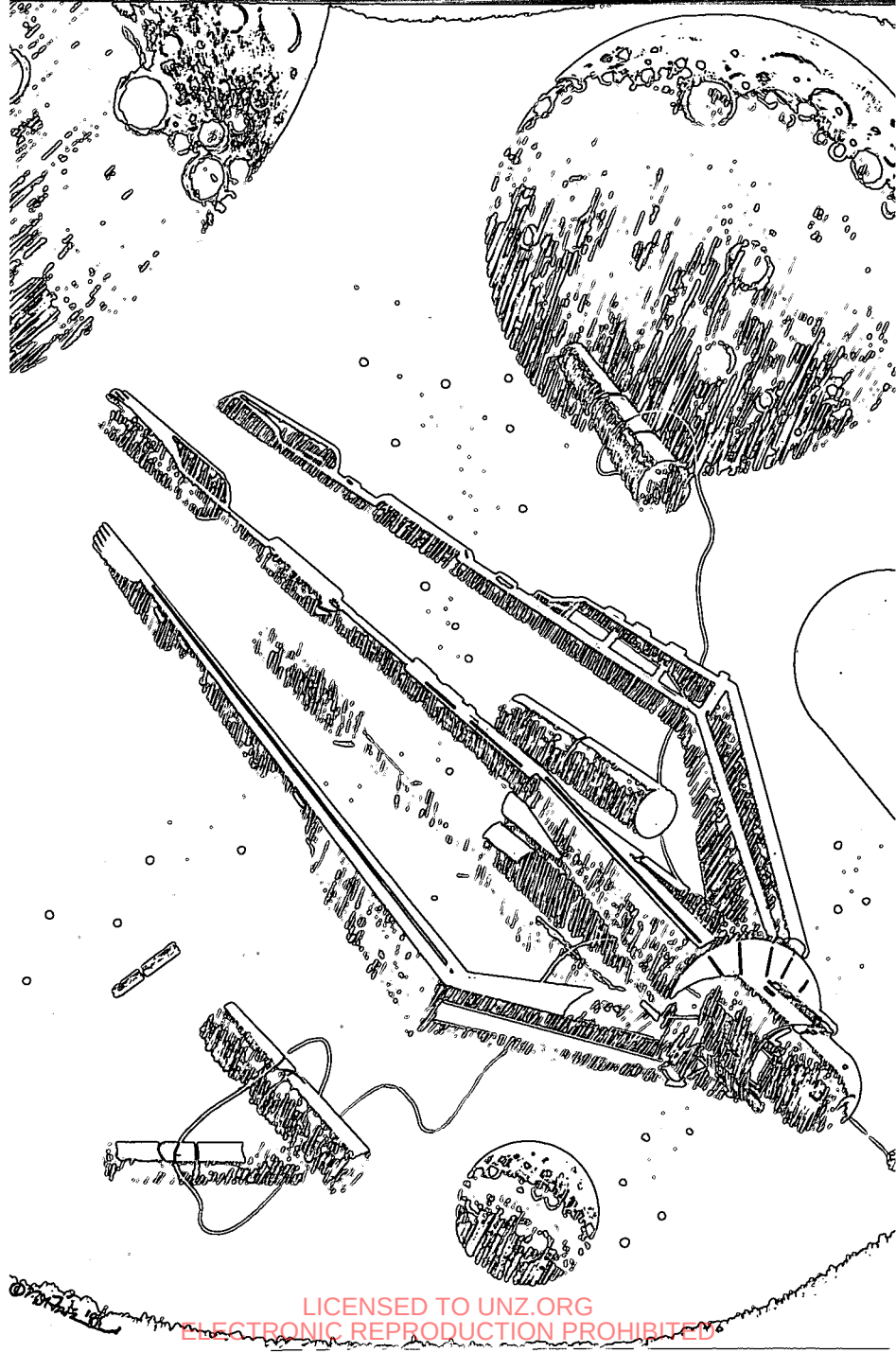

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wake him, and they would exchange services; he relieving her tingling breasts of milk, the milk relieving his hungry tummy—moms need babes, she thought sleepily, as much as babes need moms, an interlocking design, two individuals sharing one biological system . . . so the quaddies shared the technological system of the Habitat, each dependent on all the others . . .

Dependent on her work, too. What was next? Germination boxes, grow tubes—no, she could not yank grow tubes around today, today was Acceleration Day—her eyes sprang open. And widened in joy.

"Tony!" she breathed. "How long have you been here?"

"Been watching you abou' fifteen minutes. You sleep pretty. Can I come in?" He hung in air, dressed again in his familiar, comfortable red T-shirt and shorts, watching her in the half-light of her chamber. "Gotta tie down anyway, acceleration's about to start."

"Already. . . ?" She wriggled aside and made room for him, entwining their arms, touching his face and the alarming bandage still wrapping his torso. "Are you all right?"

"All right now," he sighed happily. "Lying there, in that hospital—well, I didn't expect anyone to come after me. Horrible risk to you—not worth it!" He nuzzled her hair.

"We talked about it, the risk. But we couldn't leave you. Us quaddies—we've got to stick together." She was fully awake now, reveling in his physical reality, muscled hands, bright eyes, fuzzy blond brows. "Losing you would have diminished us, Leo said, and not just genetically. We have to be a people now, not just Claire and Tony and Silver and Siggy—and Andy—I guess it's what Leo calls 'synergistic'. We're something synergistic now."

A strange vibration purred through the walls of her chamber. She hitched around to scoop Andy out of his sleep restraints beside her, and fold him to her with her upper hands while still holding Tony's lowers with her lowers, under the sleep sack's cover. Andy squeaked, lips smacking, and fell back to sleep. Slowly, gently, her shoulderblades began to press against the wall.

"We're on our way," she whispered. "It's starting . . ."

"It's holding together," Tony observed in wonder. They clung to each other. "Wanted to be with you, at this moment . . ."

She let the acceleration have her, laying her head against the wall, cushioning Andy on her chest. Something went *clunk* in her cupboard; she'd check it later.

"This is the way to travel," sighed Tony. "Beats stowing away . . ."

"It's going to be strange, without GalacTech," said Claire after a while. "Just us quaddies . . . what will Andy's world be like, I wonder?"

"That'll be up to us, I guess," said Tony soberly. "That's almost scarier than downsiders with guns, y'know? Freedom. Huh." He shook his head. "Not like I'd pictured it."

Yei's suggested sleep was out of the question. Morosely, Van Atta returned not to his living quarters, but to his own downside office. He had not checked in there for a couple of weeks. It was about midnight now, Shuttleport Three

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time; his downside secretary was off-shift. It suited his foul humor to sulk alone.

After about twenty minutes spent muttering to himself in the dim light, he decided to scan his accumulated electronic mail. His usual office routine had gone to pot these last few weeks anyway, and of course the events of the last two days had blown it entirely to hell. Perhaps a dose of boring routine would calm him enough to consider sleep after all.

Obsolete memos, out-of-date requests for instructions, irrelevant progress reports—the quaddie downside barracks, he noted with a grim snort, was advertised as ready for occupancy at fifteen percent over budget. If he could catch any quaddies to put in them. Instructions from HQ viz wrapping up the Cay Project, unsolicited advice upon salvage and disposal of its various parts . . .

Van Atta stopped abruptly, and backed up two screens on his vid. What had that said again?

Item: Post-fetal experimental tissue cultures. Quantity: 1000. Disposition: cremation by IGS Standard Biolab Rules.

He checked the source of the order. No, it hadn't come through Apmad's office, as he'd first guessed. It came from General Accounting & Inventory Control, part of a long computer-generated list including a variety of lab stores. The order was signed by a human, though, some unknown middle manager in the GA&IC back on Earth.

"By damn," Van Atta swore softly, "I don't think this twit even knows what quaddies *are*." The order had been signed some weeks before.

He read the opening paragraph again. *The Project Chief will oversee the termination of this project with all due speed. The quick release of personnel for other assignments is particularly desirable. You are authorized to make whatever temporary requisitions of material or personnel from adjacent divisions you require to complete this termination by 6/1.*

After another minute his lips drew back in a furious grin. Carefully, he pulled the precious message disc from the machine, pocketed it, and left to go find Chalopin. He hoped he might rout her out of bed.

CHAPTER SIXTEEN

"Aren't you about done out there yet?" Ti's taut voice crackled through Leo's worksuit comm.

"One last weld, Ti," Leo answered. "Check that alignment one more time, Tony."

Tony waved a gloved hand in acknowledgment and ran the optical laser check up the line that the electron beam welder would shortly follow. "You're clear, Pramod," he called, and moved aside.

The welder advanced in its track across the workpiece, stitching a flange for the last clamp to hold the new vortex mirror in place in its housing. A light on the beam welder's top flashed from red to green, it shut itself off, and Pramod moved in to detach it. Bobbi floated up immediately behind to check the weld with a sonic scan. "It's good, Leo. It'll hold."

"All right. Clear this stuff out and bring the mirror in."

His quaddies moved fast. Within

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minutes the vortex mirror was fitted into its insulated clamps, its alignment checked. "All right, gang. Let's move back and let Ti run the smoke test."

"Smoke test?" Ti's voice came over the comm. "What's that? I thought you wanted a ten percent power-up."

"It's an ancient and honorable term for the final step in any engineering project," Leo explained. "Turn it on, see if it smokes."

"I should have guessed," Ti choked. "How very scientific."

"Use is always the ultimate test. But power-up slowly, eh? Gently does it. We've got a delicate lady here."

"You've said that about eight or ten times, Leo. Is that sucker in spec or out?"

"In. On the surface, anyway. But the internal crystalline structure of the titanium—well, it just isn't as controlled as it would have been in a normal fabrication."

"Is it *in* spec or *out?* I'm not going to Jump a thousand people to their deaths, dammit. Especially if I'm included."

"In, in," Leo spoke through his teeth. "But just—don't horse it around, huh? For the sake of my blood pressure, if nothing else."

Ti muttered something; it might have been, *Screw your blood pressure,* but Leo wasn't sure. He didn't ask for a repeat.

Leo and his quaddie work gang gathered their equipment and jetted a safe distance from the Necklin rod arm. They hung a hundred meters or so above Home. The light of Rodeo's sun was pale and sharp here within an hour of the wormhole Jump point; more than a bright star, but far less than the nuclear furnace that had warmed the Habitat in Rodeo orbit.

Leo seized the moment to gaze upon their cobbled-together colony ship from this rare exterior vantage. Over a hundred modules had finally been bundled together along the ship's axis, all carrying on—more or less—their previous functions. Damned if the design didn't look almost intended, in a lunatic-functional sort of way. It reminded Leo a bit of the thrilling ugliness of the early space probes of the Twentieth and Twenty-first centuries.

Miraculously, it had held together under two days steady acceleration and deceleration. Inevitably items here and there Inside had been found to have been overlooked. The younger quaddies had crawled about bravely, cleaning up; Nutrition had managed to get everyone fed something, though the menu was a trifle random; thanks to yeoman efforts on the part of the young airsystems maintenance supervisor who had stayed on and his quaddie work gang, they no longer had to cease accelerating periodically for the plumbing to work. For a while Leo had been convinced the potty stops were going to be the death of them all, not that he hadn't grabbed the opportunities himself for the final touching-up on their vortex mirror.

"See any smoke?" Ti's voice inquired in his ear.

"Nope."

"That's all, then. You people better get your asses Inside. And as soon as you've got everything nailed down, Leo, I'd appreciate it if you'd come up to Nav and Com."

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Something in the timbre of Ti's voice chilled Leo. "Oh? What's up?"

"There's a Security shuttle closing on us from Rodeo. Your old buddy Van Atta's aboard, and ordering us to halt and desist. I don't think there's much time left."

"You're still maintaining comm silence, I trust?"

"Oh, yeah, sure. But that doesn't prevent me from listening, eh? There's a lot of chatter from the Jump Station —but that doesn't worry me as much as what's coming up from behind. I, um . . . don't think Van Atta handles frustration too well."

"On edge, is he?"

"Over the edge, I think. Those Security shuttles are armed, y'know. And a lot faster than this monster in normal space. Just 'cause their lasers are classed as 'light weaponry' doesn't mean it's exactly healthy to stand around in front of 'em. I'd just as soon Jump *before* they got in range."

"I read you." Leo waved his work gang toward the entry hatch to the work-suit locker module.

So it was coming at last. Leo had devised a dozen defenses in his mind, upended beam welders, explosive mines, for the long-anticipated physical confrontation with GalacTech employees trying to re-take the Habitat. But all his time had been gobbled up by the vortex mirror, and as a result only the most instant of weapons, such as the beam welders, were now available, and even they would have no use Indoors in a boarding battle. He could just picture one missing its target and slicing through a wall into an adjoining crèche module. Hand-to-hand in free fall the quaddies might have some advantage; weapons cancelled that, being more dangerous to the defenders than the attackers. It all depended on what kind of attack Van Atta launched. And Leo hated depending on Van Atta.

Van Atta swore into the comm one last time, then dealt the off-key an angry blow. He had run out of fresh invective hours before, and was conscious of repeating himself. He turned from the comm console and glowered around the Security shuttle's control compartment.

The pilot and co-pilot, up front, were busy about their work. Bannerji, commanding the force, and Dr. Yei—and how had she inserted herself into this expedition, anyway?—were strapped to their acceleration couches, Yei in the engineer's seat, Bannerji holding down the weapons console across the aisle from Van Atta.

"That's it, then," snapped Van Atta. "Are we in range for the lasers yet?"

Bannerji checked a readout. "Not quite."

"Please," said Dr. Yei, "let me try to talk to them just once more—"

"If they're half as sick of the sound of your voice as I am, they're not going to answer," growled Van Atta. "You've spent hours talking to them. Face it—they're not *listening* any more, Yei. So much for psychology."

The Security sergeant, Fors, stuck his head through from the rear compartment where he rode with his twenty-six fellow GalacTech guards. "What's the word, Captain Bannerji? Should we suit up for a boarding yet?"

Bannerji quirked an eyebrow at Van Atta. "Well, Mr. Van Atta? Which plan

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is it to be? It appears we're going to have to cross off all the scenarios that started with their surrendering."

"You got that shit straight." Van Atta brooded at the comm, which emitted only a grey empty hiss on its vid. "As soon as we're in range, start firing on 'em, then. Disable the Necklin rod arms first, then the normal space thrusters if you can. Then we blast a hole in the side, march in, and mop up."

Sergeant Fors cleared his throat. "You did say there were a *thousand* of those mutants aboard, didn't you, Mr. Van Atta? What about the plan of skipping the boarding part and just taking the whole vessel in tow, back to wherever you want it? Aren't the odds a little, um, lopsided for boarding?"

"Complain to Chalopin, she's the one who balked at drafting help from outside Security proper. But the odds aren't what they appear. The quaddies are creampuffs. Half of them are children under twelve, for God's sake. Just go in, and stun anything that moves. How many five-year-old girls do you figure you're equal to, Fors?"

"I don't know, sir," Fors blinked. "I never pictured myself fighting five-year-old girls."

Bannerji drummed his fingers on his weapons console and glanced at Yei. "Is that girl with the baby aboard, the ones I almost shot that day in the warehouse, Dr. Yei?"

"Claire? Yes," she replied levelly.

"Ah." Bannerji glanced away from her intent gaze, and shifted in his seat.

"Let's hope your aim is better this time, Bannerji," said Van Atta.

Bannerji rotated a computer schematic of a Superjumper in his vid, running calculations. "You realize," he said slowly, "that the real event is going to have some uncontrolled factors—the probability is good that we're going to end up punching some extra holes in the inhabited modules while we're going for the Necklin rods."

"That's all right," said Van Atta. Bannerji's lips screwed up doubtfully. "Look, Bannerji," added Van Atta impatiently, "the quaddies are—ah, have made themselves expendable by turning criminal. It's no different than shooting a thief fleeing from any other kind of robbery or break-in. Besides, you can't make an omelette without breaking eggs."

Dr. Yei ran her hands hard over her face. "Lord Krishna," she groaned. She favored Van Atta with a tight, peculiar smile. "I've been wondering when you were going to say that. I should have put a side bet on it—run a pool. . . ."

Van Atta bristled defensively. "If you had done your job right," he returned no less tightly, "we wouldn't be here now breaking eggs. We could have boiled them in their shells back on Rodeo at the very least. In fact I intend to point out to management later, believe me. But I don't have to argue with you any more. For everything I intend to do, I have a proper authorization."

"Which you have not shown to me."

"Chalopin and Captain Bannerji saw it. If I have my way you'll get a termination out of this, Yei."

She said nothing, but acknowledged the threat with a brief ironic tilt of her head. She leaned back in her chair and crossed her arms, apparently silenced

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at last. *Thank God,* Van Atta added to himself.

"Get suited up, Fors," he told the Security sergeant.

Nav and Com in the D-620 was a crowded chamber. Ti ruled from his control chair, enthroned beneath his headset; Silver manned the comm; and Leo—held down the post of chief engineer, he supposed. The chain of command became rather blurred at this point. Perhaps his title ought to be, Official Ship's Worrier. His guts churned and his throat tightened as all lines of action approached their intersection at the point of no return.

"The Security shuttle has stopped broadcasting," Silver reported.

"That's a relief," said Ti. "You can turn the sound back up, now."

"Not a relief," denied Leo. "If they've stopped talking, they may be getting ready to open fire." And it was too late, too close to Jump point to put a beam welder and crew Outside to fire back.

Ti's mouth twisted in dismay. He closed his eyes; the D-620 seemed to tilt, lumbering under acceleration. "We're almost in position to Jump," he said.

Leo eyed a monitor. "They're almost in range to fire." He paused a moment, then added, "They *are* in range to fire."

Ti made a squeaking noise, and pulled his headset down. "Powering-up the Necklin field—"

"*Gently,*" yelped Leo. "My vortex mirror—"

Silver's hand sought Leo's. He was overwhelmed with a desire to apologize, to Silver, to the quaddies, to God, he didn't know who. *I got you into this—I'm sorry. . . .*

"If you open a channel, Silver," said Leo desperately, his head swimming in panic—all those children—"We could still surrender—"

"Never," said Silver. Her grip tightened on his hand, and her blue eyes met his. "And I choose for all, not just for myself. We go."

Leo ground his teeth, and nodded shortly. The seconds thudded in his brain, syncopated with the hammering of his heart. The Security shuttle grew in the monitor.

"Why don't they fire now?" asked Silver.

"Fire," ordered Van Atta.

Bannerji's bright computer schematics drew toward alignment, numbers flickering, lights converging. Dr. Yei, Van Atta noticed, was no longer in her seat. Probably hiding out in the toilet chamber. This dose of real life and real consequences was doubtless too much for her. *Just like one of those wimp politicians,* Van Atta thought scathingly, *who talks people into disaster and disappears when the shooting starts. . . .*

"Fire *now,*" he repeated to Bannerji, as the computer blinked readiness, locked onto its target.

Bannerji's hand moved toward the firing switch, hesitated. "Do you have a work order for this?" he asked suddenly.

"Do I have a *what?*" said Van Atta.

"A work order. It occurs to me that, technically, this could be considered an act of hazardous waste disposal. It takes a work order signed by the originator of the request—that's you—my super-

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visor—that's Administrator Chalopin—and the company Hazardous Waste Management Officer."

"Chalopin has turned you over to me. That makes it official, mister!"

"But not complete. The Hazardous Waste Management Officer is Laurie Gompf, and she's back on Rodeo. You don't have *her* authorization. The work-order is incomplete. Sorry, sir." Bannerji vacated the weapons console and plunked himself down in the empty engineer's seat, crossing his arms. "It's as much as my job is worth to complete an act of hazardous waste disposal without a proper order. The Environmental Impact Assessment has to be attached, too."

"This is mutiny!" yelled Van Atta.

"No, it isn't," Bannerji disagreed cordially. "This isn't the military."

Van Atta glared red-faced at Bannerji, who studied his fingernails. With an oath, Van Atta flung himself into the weapons console seat and reset the aim. He might have known—anything you wanted done right you had to do yourself—he hesitated, the engineering parameters of the D-class Superjumpers racing through his mind. Where on that complex structure might a hit not merely disable the rods, but cause the main thrusters to blow entirely?

Cremation, indeed. And the deaths of the four or five downsiders aboard could, at need, be blamed on Bannerji—*I did my best, ma'am—if he'd done his job as I'd first requested. . . .*

The schematic spun in the vid display. There must be a point in the structure—yes. There and there. If he could knock out both *that* control nexus and *those* coolant lines, he could start an uncontrolled reaction that would result in—promotion, probably, after the dust had settled. Apmad would kiss him. Just like a heroic doctor, singlehandedly stopping a plague of genetic abomination from spreading across the galaxy . . . .

The target schematic pulled toward alignment again. Van Atta's sweating palm closed around the firing switch. In a moment—just a moment—

"What are you doing with *that,* Dr. Yei?" asked Bannerji's voice in startlement.

"Applying psychology."

The back of Van Atta's head seemed to explode with a sickening crack. He pitched forward, cutting his chin on the console, bumping the keypads, turning his firing program to confetti-colored hash in the vid. He saw stars *inside* the shuttle, blurring purple and green spots—gasping, he straightened back up.

"Dr. Yei," Bannerjei objected, "if you're trying to knock a man out you've got to hit him a *lot* harder than that."

Yei recoiled fearfully as Van Atta surged up out of his seat. "I didn't want to risk killing him. . . ."

"Why not?" muttered Bannerji under his breath.

Furiously, Van Atta's hands closed around Yei's wrist. He yanked the metal wrench from her grasp. "You can't do anything right, can you?" he snarled.

She was gasping and weeping. Fors, space-suited but still minus his helmet, stuck his head through again from the rear compartment. "What the hell is going on up here?"

Van Atta shoved Yei toward him. Bannerji, squirming uncomfortably in

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his seat, was clearly not to be trusted. "Hold onto this crazy bitch. She just tried to kill me with a wrench."

"Oh? She told *me* she needed it to adjust a seat attitude," remarked Fors. "Or—did she say 'seat'?" But he held Yei's arms. Her struggle, as ever, was weak and futile.

With a hiss, Van Atta heaved himself back into the weapons console seat and called up the targeting program again. He reset it, and switched on the view from the exterior scanners. The D-620-Habitat configuration stood out vividly in the vid, the cold and distant sunlight silver-gilding its structure. The schematics converged, caging it.

The D-620 wavered, rotated, and vanished.

The lasers fired, lances of light striking into empty space.

Van Atta howled, beating his fists on the console, blood droplets flicking from his chin. "They got *out*. They got *out*. They got *out*—"

Yei giggled.

Leo hung limply in his seat restraints, laughter bubbling in his throat. "We made it!"

Ti swung his headset up and sat no less limply, his face white and lined —Jumps drained pilots. Leo felt as if he'd just been twisted inside out himself, squeaking, but the nausea passed quickly.

"Your mirror was in spec, Leo," Ti said faintly.

"Yes. I'd been afraid it might explode, during the stresses of the Jump."

Ti eyed him indignantly. "That's not what you *said*. I thought you were the hot-shot testing engineer."

"Look, I'd never made one of those things before," Leo protested. "You never *know*. You only make the best possible guesses." He sat up, trying to gather his scattered wits. "We're here. We made it. But what's going on Outside, was there any damage to the Habitat—Silver, see what you can get on the comm."

She too was pale. "My goodness," she blinked. "So that was a Jump. Sort of like six hours of Dr. Yei's truth serum all squeezed into a second. Ugh. Are we going to be doing this a lot?"

"I certainly hope so," said Leo. He unstrapped himself and floated over to assist her.

Space around the wormhole was empty and serene—Leo's secret paranoid vision of Jumping into waiting military fire was not to be, he noted gladly. But wait, a ship was approaching them—not a commercial vessel, something dangerous and official-looking. . . .

"It's some sort of police ship from Orient IV," Silver guessed. "Are we in trouble?"

"Undoubtedly," Dr. Minchenko's voice cut in as he floated into Nav and Com. "GalacTech will certainly not take this lying down. You will do us all a favor, Graf, if you let me do the talking just now." He elbowed both Silver and Leo aside, taking over the comm. "The Minister of Health of Orient IV happens to be a professional colleague of mine. While his is not a position of great political power, it is a channel of communication to the highest levels of government. If I can get through to him we will be in a much better position than if we try to deal with some low level police sergeant, or worse, military of-

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ficer.'' Minchenko's eyes glinted. ''There is no love lost between GalacTech and Orient IV at the moment. Whatever GalacTech's charges, we can counter —tax fraud—oh, the possibilities . . .''

''What do we do while you're talking?'' asked Ti.

''Keep boosting,'' advised Minchenko.

''It's not over, is it?'' Silver said quietly to Leo, as they floated out of Minchenko's way. ''Somehow, I thought our troubles would be over if only we could get away from Mr. Van Atta.''

Leo shook his head. A jubilant grin still kept crooking up the corners of his mouth. He took one of her upper hands. ''Our troubles would have been over if Brucie-baby had scored a hit. Or if the vortex mirror had blown up in the middle of the Jump, or if—don't be afraid of troubles, Silver. They're a sign of life. We'll deal with them together —tomorrow.''

She breathed a long sigh, the tension draining from her face, her body, her arms. An answering smile at last lighted her eyes, making them bright like stars. She turned her face expectantly toward his.

He found himself grinning quite foolishly, for a man pushing forty. He tried to twitch his face into more dignified lines. There was a pause.

''Leo,'' said Silver in a tone of sudden insight, ''are you *shy*?''

''Who, me?'' said Leo.

The blue stars squeezed for a moment into quite predatory glitters. She kissed him. Leo, indignant at her accusation, kissed her back more thoroughly. Now it was her turn to grin foolishly. A lifetime with the quaddies, Leo reflected, could be all right. . . .

They turned their faces to the new sun. ■

CLARION WEST ANNOUNCES 1988 WRITERS' WORKSHOP

The fifth annual Clarion West science fiction and fantasy writing workshop will be held from 19 June-31 July 1988 at Seattle Central Community College, with writers-in-residence: **Orson Scott Card, Elizabeth Lynn, Greg Bear, Joan Vinge, Gardner Dozois,** and **Peter S. Beagle.**

Applications are now being accepted. Approximately 20 students will be selected from the applicants. Tuition until 1 March 1988 is $925. Late applications will be considered until 15 April 1988, at a cost of $975. College credit and dormitory lodging are available, but are not covered by tuition. Limited scholarships are available.

To apply, submit 20-30 pages of manuscript (one or two short stories or a novel excerpt with outline) with a cover letter describing your background and reasons for wanting to attend Clarion West, and a $50 refundable deposit payable to Clarion West. Send to: Clarion West, 340 15th Avenue East, Suite 350, Seattle, WA 98112.

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G. Harry Stine and Wilfred C. Smith

LAUGHING ALL THE WAY TO ORBIT

The road to space is paved with hurdles, all of which must be cleared— and only some of which are technical.

Back in the 1930s, Austrian space pioneer Count Guido von Pirquet said, "With regard to space flight, there are three things to do: One, get the money. Two, get the right people on the job. And, three, get the wrong people off the job."

Fifty years later, we are finally beginning to heed his advice.

We seem to be no closer to being able to buy a ticket to the Moon today than we were fifty years ago. Certainly, twelve people have walked on the Moon, but that was ancient history. Read on.

A great deal has been said and written about the last two factors in Von Pirquet's equation. Engineers, technophiles, and space advocates have been busily engrossed in this for the past forty years. None of them seemed to worry very much about the first element in the equation: Get the money. The attitude was and still is: Not to worry; when we've got the technology to do it, the money will be there somehow. People will throng to invest their hard-earned money in glamorous space ventures.

As a result, a lot of dreams have appeared as scientific papers, technical reports, and aerospace company studies. Most of these have contained far too many naive assumptions in the areas of technology, marketing, investment, and business planning. We believe it's time to stop building castles in the air whether they be space transportation systems, space colonies, or space exploitation concepts. It's not our purpose here to point out why such articles and papers have come to naught but why such neat technical ideas and concepts usually never come to fruition at all.

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And why, if we continue down the same well-worn path, ignoring the first element in the Von Pirquet equation, our grandchildren will remain on Earth while those from other nations exploit the solar system. Then we'll tell you what must be done *now* and from *now on* if we wish to become a spacefaring free people exploiting the riches of the solar system. We share two basic philosophies. The first is that we can do anything we want to do provided we can pay for it and are willing to live with the consequences. The second is that the way we go about doing it should make the rich richer, the poor richer, and the IRS poorer.

Henry David Thoreau once wrote, "If you have built castles in the air, your work need not be lost; there is where they should be. Now build your foundations under them."

To crib a line from another science fiction author, Martin Caidin, "We have the technology." Let's start with that reality. It's not an assumption. The technology to design, build, and operate reliable, reuseable, low-cost space transportation systems exists. It's on the shelf. We've already paid for it—about $75 billion to $100 billion, depending on whose figures you use and believe. In the last thirty years, the federal government has footed the bill in the name of national prestige (and, therefore, national security) through the Department of Defense and the National Aeronautics and Space Administration (NASA). Created in 1958, NASA's *only* real and unambiguous purpose is that of technology development. It has taken on other tasks under orders from above or through its own internal policy-making activities.

In thirty years, NASA has developed three space transportation systems. Only three. Each has been an enormous technical step forward accompanied by great risk and great cost. This is in direct contrast to the development of commercial air transportation systems from 1927 through 1957, another thirty-year time period during which NASA's predecessor, the National Advisory Committee on Aeronautics (NACA), did some fine government-funded research which was then used by private enterprise to develop a whole series of systems in a step-by-step *evolution*, each new system making only minor improvements on the prior one. Thus, the United States went from the Ford Trimotor to the Boeing 247 to the Douglas DC-3 to the Douglas DC-4 to the Boeing 377 to the Lockheed L-049 Constellation to the Douglas DC-7C to the Boeing 707 and Douglas DC-8 in a thirty-year time period. The airports of 1930 bear little resemblance in appearance or operation to those of 1960. Check it out. Compare Floyd Bennett Field (if you can find it; it's now a Coast Guard helicopter base) with John F. Kennedy International Airport just across Jamaica Bay. Or Glendale's Grand Central Air Terminal (if you can find it; it's now an industrial park but the old terminal is still there) with Los Angeles International.

Obviously, we've been doing something wrong in space transportation.

It's not because engineers aren't as smart or smarter than the old aeronautical engineers such as William Stout, James H. "Dutch" Kindelberger, Lee

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Atwood, Ed Heinemann, Edward C. Wells, or Clarence "Kelly" Johnson. Nor are the current aerospace executives and managers any less savvy than Edsel Ford, Donald W. Douglas, Jack Frye, Pat Patterson, or William T. Allen. (If you don't know who they are, we suggest you read up on aviation history because *they* were highly successful, made a lot of money, and created the world's finest air transportation system. They understood and followed the basics we'll discuss herein.)

The first thing we must stop doing is believing in the cover stories of *Popular Mechanics* and even the journals of the professional aerospace societies. A spacecraft doesn't have screen doors, a front porch, and a brass door knocker. Nor will any modification of an ornithopter do the job. Nor will hot-air balloons or a Boeing 747 really be useful in replacing a first stage. We *must* begin thinking about a real Space DC-3, something using existing technology that will make money doing a job for which a market, and therefore paying customers, exist.

The next thing we must do is quit believing in Santa Claus or Daddy Warbucks. The money will not come from the government, but from private capital sources. Where is D.D. Harriman now that we need him? The last we knew, he's still in the Library of Congress neatly filed under "Fiction." The idea that we can finance a true space transportation system with government funding is ludicrous; the STS space shuttle proved that beyond the shadow of a doubt. We paid over $25 billion dollars to get a space transportation system that didn't meet a single one of its design goals or fulfill a single NASA promise; it isn't reliable, reusable, economical, or even reasonably safe. And it can't possibly be modified to be any of the above. Obviously, we must therefore build a space transportation system that is all of the above.

We can do it. The technology is there. But forget about financing the project by painting soft drink labels on the side of the spacecraft. Stop looking for eccentrics who are willing to put $500,000 of hard cash money into non-voting stock on the promise of getting a seat assignment on the passenger manifest. Anyone who could write that kind of a check on that kind of a whim would have been discovered and fleeced by in-laws, outlaws, or religious fundraisers with begging bowls or satellite dishes long before the space advocates could get a shot at him.

So how do we do it?

When space, like all other historical frontiers, attracts the serious attention of business people, as it must, it will be done by professionals as serious in the art and science of finance and marketing as their compatriots are in the art and science of engineering. All have always been required. All will always be required.

As long as ten years ago, one of the authors was pointing out to the technologists and space advocates that space wasn't a technology game nor a political game; it was a money game. "Learn to talk to the financiers, venture capitalists, and investment bankers," was the advice given but not taken. So he finally found the other author of this article, a

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man who is not an engineer, not an astronaut, not a physicist, and not even a science-fiction writer. We share an interest in the hopeful future, and that's what brought us together.

G. Harry Stine is familiar to readers, Wilfred C. Smith is a pseudonym and has to be because he's a vice-president of a very, very large Wall Street investment firm where SEC and stock market regulations are far more sensitive than government Top Secret security clearance restrictions could ever hope to be. Smith has a track record of fifteen years in financial services and is Street smart (Wall Street, of course, being the only street referred to by initial caps). He's already raised tens of millions of dollars for research and development in the private sector for projects similar to the commercial development of space. Neither of us are gadflies, Luddites, or dream destroyers. We intend to provide some constructive input to the process of true commercial development of space.

The technology is there; the amount of space technology developed by NASA, the Department of Defense, and their contractors over the last thirty years is enormous. Most of it has been used once and put aside in the eternal quest for new technology which is what the government was willing to pay for. For future (next week) commercial space ventures, we're talking about using this paid-for off-the-shelf technology that can provide us with both expendable multi-staged spacecraft and single-stage-to-orbit reuseable spacecraft capable of carrying four to ten tons of payload to orbit at costs of less than $500 per pound. See any aerospace engineer who hasn't been corrupted by the eternal quest for newer, faster, and glitzier regardless of the cost. Or visit the National Air and Space Museum with a camera and measuring tools.

Markets exist or can be developed. We're talking billion-dollar markets. Some of them have been exploited already and can be penetrated more deeply using better application of technology. Others have yet to be examined with the same care that any prudent company exhibits in its everyday quest for survival and growth. Two methods of market analysis can be used. One: With known technology, what existing markets can be served better or more economically? What markets would exist and how big would they be if existing technology could be harnessed to create the markets? No need to explain this; see any good marketing expert or book about marketing.

The money is there. We're talking prime sources of capital that are very large. Consumer spending in the United States amounts to trillions of dollars per year; this is money in circulation making more money which must be then invested. Capital creates capital by prudent investment of profits. Capital growth is exponential in nature. Capital must be continually put to work by investing it in new ventures that have varying degrees of risk, the most investment capital going into the least risky ventures (or those perceived to be the least risky). Again, nothing new or arcane here; talk to any banker or broker or see any elementary business economics text.

Existing technology, good market-

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ing, and available capital are the mainstays of commercial space development just as they have been for the clipper ships, the railroads, the telephone, radio, television, automobiles, commercial aviation, and computers. These same three historical movers and shakers of international economies are the keys to persuading bankers, brokers, and investors alike to rally to the true purposes of the space enterprise: making money and creating even more capital. If the financial people believe that space industry and commerce will do this, they'll provide the money necessary for the engineers to do their thing, which in turn will allow the space advocates to buy their tickets to the Moon.

But not if they continue to be presented with what they consider to be far-out dreams whose technology is something that has yet to be developed—they don't want to understand the technology; they're interested in the financial aspects—and whose numbers don't even make good sense, much less have any sort of business plan behind them.

For example, most intelligent investment bankers and brokers these days question the issuance of non-voting stock because the various securities regulatory agencies are presently on the verge of outlawing non-voting stock altogether, even if backed by tangible assets. The "one share, one vote" concept is regarded as something of a Magna Carta, and it would be a poor start to build a fledgling space transportation company's capital fund by raising policies on grounds which regulators already consider to be dubious. Leave that sort of thing to the swamp salesmen. Credibility is too important to squander in Square One . . .

And forget about trying to finance a space transportation company with advertising and promotional revenues. One of the concepts behind a viable commercial space transportation industry is routine launches. Even the NASA space shuttle, which was about as far from a true commercial space transportation system as you could get—it was impossible to make money with it even if the government *gave* it away to a commercial operator!—began to lose its media fascination, and it became difficult to see a shuttle launch on live network TV by the time the 24th mission rolled around. Commercial space launches will and *should* attract about as much media attention as a Boeing 727 leaving LaGuardia. That sort of thing hardly excites the Madison Avenue types at BBD&O or Y&R, and even less so the jaded news types at the *New York Times* or CBS News. But, more importantly, there just isn't enough money in it. If there were, a consortium of New York City cab companies would buy out NASA, and Danny DeVito would have the starring role in the TV series based on "The Right Stuff."

And also forget trying to build and/or operate a space transportation system using "NASA economics." A recent article herein proposed a spaceplane project with 400 salaried employees and an annual payroll of $52 million. It may be hard to find people willing to invest their hard-earned money in this company if the average cost per employee —overhead, perks, social security, pension offset, hospitalization, annual leave,

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the employee parking lot and the company cafeteria plus (oh, yes) salary —comes out to $130,000. Most industries have far lower overheads, and we know one aerospace rocket company that runs very well, thank you, on a 30% overhead figure. (Model rocket companies, by the way, operate with far less overhead than that. They're in a highly competitive marketplace; they have to.) On the other hand, the budget line item of $15 million for the lawyer met with no objections from any of the attorneys we polled, so we'll assume that figure is acceptable to the American Bar Association and let it stand.

As a matter of fact, let's let the whole thing stand for a moment while we address the not-so-minor matter of raising the funds to build this spacecraft in the first place.

Again, "NASA economics" are apparent in the subject article: "Let's assume a manufacturing cost of $4 billion . . . The Japanese intend to spend $800 million developing their H-2 launch vehicle, including the launch site, engine development, and first flight, so our $4 billion development number should be conservative." These may be what are considered real-world numbers in the aerospace business where a Boeing 747 now costs about $85 million (less batteries), but it may also be indicative of why anything made by Sony or Toshiba costs less than a comparable appliance from RCA, Westinghouse, or GE. While we don't want to concentrate on the concept of out-spending the Japanese by a factor of five to one in the space launch business as being less than conservative, let's go on with the notion that this project is to be carried out without government funding.

A few years ago, one of us participated in the largest initial public stock offering in the history of this Republic to that time, a little matter of the Rockefeller interests selling off Rockefeller Center in New York City. A little over $1 billion was raised. That's in the ballpark—give or take a few billion—of the amount quoted as manufacturing costs for a new spacecraft. However, the Rockefeller Center deal was quite different. It involved an investment that was *immediately* liquid, could be traded on the New York Stock Exchange, and was capable of generating immediate cash flow from rents the moment the investors bought their shares. Recently, the federal government sold-off or "privatized" an operating, revenue-generating government corporation known as ConRail for the record price of $1.3 billion, making it the largest deal in the history of capitalism. Be that as it may, the *average* venture capital deal is in the range of $1 million to $10 million. So where does the "conservative" idea of $4 billion for the funding of a space transportation company come from?

Between us, we think we've figured it out. There probably aren't two aerospace engineers in America who haven't sat down over coffee or a beer and said, "Y'know what I'd do if I ran NASA?" (Or McDonnell Douglas, or Boeing, or General Dynamics, or Martin-Marietta.)

On the other hand, there were indeed a lot of computer engineers a while back who said, "Y'know what I'd do if I ran IBM?"

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The disenchanted aerospace engineers don't really look at NASA and its aerospace contractors as competitors. On the other hand, the disenchanted computer engineers looked at IBM as a competitor. Now it would seem to be reasonable as well as non-suicidal to be thinking of a business plan that doesn't assume on the first day out the fledgling new company will be going head to head with the world heavyweights. Some of the computer engineers who did indeed start their own little operation in a garage made it in a big way *in spite of the heavyweight competition*, and we think it might be instructive to potential space transportation moguls if we took a look at some of these successes.

Once upon a time, computers meant mainframes—big, serious, expensive, complex machines built for government, academic, and corporate users. A 1949 marketing study proved that only *nine* large, general purpose computers—like the IBM Selective Sequence Electronic Calculator containing 12,500 vacuum tubes, 21,400 mechanical relays, and punched paper tape memories, all of which, when it worked, could add or subtract nineteen-digit numbers in 300 microseconds—would handle all the scientific computational and data management requirements of the entire United States for decades to come. Then pocket calculators and microchips came along and tech buffs began to figure out new ways to use them, modify them, and expand their computational capabilities by buying and using the growing number of off-the-shelf digital integrated circuit chips. Computer buffs who worked on the big mainframes all day long couldn't afford to buy those big toys to play with at home, but they were so fascinated by computers that they started to build their own. Computer swap meets became popular. Then some of the buffs began making memory boards, CPUs, and other computer components for other buffs.

In 1976, two computer buffs—Steven P. Jobs (then twenty-one) and Stephen G. Wozniak (then twenty-six)—collaborated on the design of a specialized plug-in board for the growing number of home-built personal computers in the Santa Clara Valley area of California. They decided to expand it into a full-fledged personal computer kit. It took them six months to design the prototype and forty hours to build it. Almost immediately, they got fifty orders for it.

To get the capital for their personal computer company, they raised $1,350 by selling Jobs's used VW van and a programmable pocket calculator. In the time-honored tradition of American entrepreneurs, they set up shop in Jobs's garage. They'd scoped-out their market and created a product that customers wanted to buy at a price they were willing to pay. The orders flowed in faster than they could ship kits out the door. Their success also showed them they were undercapitalized. So they hired a professional business manager, A. C. "Mike" Markkula, Jr. who'd been involved with marketing at both Fairchild Semiconductor and Intel Corporation. With Markkula, they were able to do some real market research and discovered the real potential of the personal

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computer market. They figured out that their "Apple" computer—so named because the apple represented the simplicity they were trying to achieve in the design and use of a personal computer—would sell better as a turn-key system. They figured out the best way to sell it and how much people would be willing to pay for it. Based on that, they developed their business plans for capital requirements, management expertise, production facilities, software support, and marketing. *Then* they went to venture capitalist Arthur Rock who had put Intel and others to business.

Others got in. Adam Osborne figured out there was a good market for portable computers, so he went into it and made some money for a while.

Then on one bright, shining morning in August 1981, the high-roller, fast-growing, free-wheelling, entrepreneurial, technophile personal computer industry woke up to discover there were indeed giants on this earth. IBM, "Big Blue," was climbing over the fences around the backyards of every small personal and business computer company with their IBM 5150 PC Personal Computer. By the end of 1983, IBM had cornered 23% of the personal computer market.

IBM also did something that was totally new to them: Instead of clinging tenaciously to such proprietary items as systems specifications and the development of software, they released the full nine yards of their PC specs and opened the doors to all comers who wanted to develop add-ons, up-grades, special boards, and software for it. Compaq is an interesting example of what happened. They used lots of IBM technology and did some innovating that's turned some very large profits.

It's important to note that none of the fledgling personal computer companies got into the business by trying to compete with IBM in the mainframe business or assumed that investors would give them enough venture capital to try.

The same sort of thing happened in the automotive industry. Forty years ago, American auto companies owned the American market outright and dominated the world markets. Then along came VW, Toyota, and others shooting at the low end market niche. A 1963 VW Beetle went for about $1,800 ($5,300 current dollars). They didn't try to match every American model and dealership location in this country, and their investors would have thought them insane to try.

So what possible lessons are in these examples for commercial space enterprises? Several.

In the first place, we know that if it's possible for a small outfit to fill a niche in a market dominated by IBM or General Motors, it's got to be possible to do the same vis-à-vis the big aerospace companies. But it's absolutely unrealistic to assume that these big outfits won't react to the competition from these upstart newcomers with their new ideas, new technical approaches, new marketing techniques, cheap-and-dirty cost-containment procedures, and generally unorthodox strategies. (We've seen some of this already, instances where people in the existing aerospace industry have said, "There's no room for amateurs in this business, and we've

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got to stop them.")

With NASA out of the private launch business—so they say; we'll see what the "exceptions" turn out to be—it's possible to identify market niches not served by the launch vehicles made by the existing aerospace companies or not served well by them in terms of cost, schedules, availability, and a host of other factors. Once these market niches have been identified, one can come up with a plan to do business in those areas. This opens up the sources of capital that were alluded to earlier: the ultimate seat of capitalism that has furnished trillions of dollars in wealth to every Fortune 500 company and all the little businesses beyond. Get to these people first, and the bankers and brokers will beat a path to your door. These people are known to the insiders and cognoscenti of Wall Street as "customers."

Without customers, you have no business plan at all. In fact, you don't even have a business.

With customers, you can make profits.

Profits will line your pockets, pay off bank loans, attract investment capital, and be pumped back into the business to generate more profits.

Dear friends, profits are the true reason why a rocket carries something rightly called a "payload."

To earn profits, you must go out and identify customers, find out what they want, discover what it's worth to them and therefore what they'll pay for it (because they, too, must operate at a profit), and then design and build something around the desires of the market, not the state of the art.

How does this work out there in the big world of free enterprise? Well, for example, if someone has a computer that can balance a checkbook or write a letter or send bills to customers, it would be logical to find out how many people want a quicker or easier or more accurate way to do these things. Then it's a good idea to find out if they're willing to pay what your computer is going to cost them to do things differently than they've been doing them for years. Or if your computer will do them faster, easier, or more accurately than they've been doing it. Or if your computer will do something of additional value to them as well. Since the telephone company and other private firms send out computerized statements, one must assume that they've found computerized record keeping and billing to be efficient and cost effective when compared to scribbling these documents on paper with quill pens. If it were not so, there would be no computers for this purpose and the market for goose quills would be a good deal stronger than it presently is. This article was written on computers because the authors have found computers to be easier, faster, and more efficient to use than scribbling in longhand on a yellow pad. Furthermore, the editor likes to see neatly-typed manuscripts on white paper, not hand-written articles on yellow pads.

So what has this to do with space? Quite a bit, actually.

Two-thirds of the world's telecommunications traffic now goes via satellites. As everyone from the local TV weather person to Ted Turner knows very well, many communications and

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weather satellites are parked out there in geosynchronous orbit and many more are waiting to be launched or would be built and launched if sufficient launch vehicles were available, especially if these launch vehicles cost less. Lower launch costs mean (a) they can launch more satellites for the same amount of money, and (b) they can launch cheaper satellites because if one of them goes toes-up, they won't go broke putting another cheapie up there in its place. It also means they have that absolute necessity of free enterprises business: Plan B, the back-up, the reserves. Federal Express always has available a spare airplane to fly on a moment's notice to any airport where another of their planes happens to get grounded by a hydraulic failure, for example. When people are paying for fast transportation of themselves or their cargoes, they react in very predictable ways if the flight is cancelled because of equipment problems: They use another airline, as many airlines are learning again the hard way at the time of this writing.

On August 15, 1986 when President Reagan announced that the ill-fated *Challenger* would be replaced, he revealed that "NASA will no longer be in the business of launching private satellites." Although NASA doesn't like this major give-away of their turf and is doing whatever it can to seek "exceptions" to the presidential directive, President Reagan essentially dismantled the federal government's 25 year subsidized space transportation monopoly.

There is now a niche in the space enterprise.

The Europeans certainly know it. Almost immediately, the European Ariane launcher was booked solid through 1992, even though the price went up 20% after the *Challenger* accident in perfect accord with classical supply and demand economics of the free marketplace (although Ariane is highly subsidized by the French and West German governments). Even the People's Republic of China got into the act with their Long March rockets and has contracts to launch two satellites formerly scheduled for the shuttle. The Soviet Union has entered the market with their *Proton* rocket.

So where are the U.S. aerospace corporations? They know about all this. We're likely to hear from some of them in the near future. But we think it unlikely that the existing American space vehicle companies will be able to break loose from "NASA economics" and get down-and-dirty competitive. However, when, for example, you see people from Boeing's commercial airliner organization getting together with the Boeing space people, you'll know something's simmering in Seattle.

So how would a budding space entrepreneur get into this market?

Every time you hear someone say, "If we can put a man on the Moon," inform them that we can't. We once could and we once did. But we're now precisely in the position of Fletcher Christian after he'd burned the H.M.S. *Bounty* in the cove at Pitcairn Island; he could call himself a sailor and seafarer, but, without a ship, he was neither. One of us has a sixteen-year-old daughter who's already dating a young man who drives a Trans Am; the U.S. put the first

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men on the Moon before either of them were born. It's ancient history. We no longer have the spacecraft to do it; possibly, we no longer have the will to do it.

Is there any good news in this? Yes, if you're an entrepreneur with a good patent attorney. The launch vehicles, rocket motors, guidance systems, and other spacegoiong equipment that got Neil Armstrong and Buzz Aldrin (and ten other men) to the surface of the Moon aren't just in the history books; they're in the public domain. You see, patents run out after seventeen years. Some bright business types who are far more interested in beating the Soviets in the marketplace rather than in the state of the art might profitably do some homework. If we had the technology then and it worked, it ought to work now. And it may be cheaper now because you don't have to stagger under the burden of R&D costs.

Remember: The personal computer companies who survived and prospered after IBM grabbed market share in 1981 *et seq*. discovered that they could clone the IBM PC at a lower price. The entrance of IBM into the personal computer market changed the name of that game from technology to marketing.

The game has changed in space transportation, too. Forget the high tech. Forget improved specific impulse. Forget developing new technology. Forget fancy and complex new ways to do the job. Take that cafeteria or bar napkin with the sketches on it and throw it away. The same goes for the envelope with the equations scribbled on the back. Go find out how many companies and governments want satellites launched. What kind of satellites? Where do they want them located in orbit? How heavy and/or big are they? Then find out the most important datum: *What are they willing to pay for this launch service?* Would they pay a little more to be launched sooner than anyone else can do it or sooner than their competitor? Arthur M. Dula, the well-known Houston space attorney, was recently quoted by Reuters news agency: "There are actually companies out there that are going to go bankrupt unless we can manage to get their satellites launched."

Unless you happen to be building launch vehicles at the moment and decide that one of your birds can be tailored to meet performance, cost, and delivery desires, you then go out and find tinbenders who actually manufacture rockets or aircraft or something incorporating similar technologies and industrial processes. Neither the big or little companies are hard to find. There are all sorts of aerospace directories, plus something called "Thomas's Register." You approach these companies, ask if they can do what you want, and get some bids from them if they think they can, emphasizing that you will pay not one thin damned dime for research or development of new technology. In short, they've got to take it off the shelf.

If a tinbender comes up with a firm price that's more than what the identified customers are willing to pay, that's a negative number; turn the page and continue dreaming about space. Any space enterprise that proceeds in the face of that negative number won't proceed very long before reading the portion of

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the book called Chapter 11.

But, if the firm bid price is less than what the customer will pay, that's a positive number and you're on your way to becoming a space mogul.

That positive number has already launched a thousand ships and built the topless towers of Gotham.

That positive number has filled the heavens with commerce, argosies of magic sails flown by pilots of the purple twilight dropping down with costly bales bearing the purple Federal Express label.

That positive number allows us to plant and harvest the amber waves of grain which feed the cattle that provide the beef for billions and billions of Big Macs.

That positive number has put a chicken in every bucket bearing the Colonel's likeness. It carries the mortgage on the house that Jack built. It even pays the taxes that have provided generations of politicians and bureaucrats with a way to live beyond their means.

That positive number gives small businesses what they need to become big businesses. Without it, big businesses are downsized to small businesses.

That positive number is *profit*.

And the future belongs to those men and women who know that when they sit down to doodle sketches of condos or clothing fashions or even spacecraft.

The future does *not* belong to those people who say it can't be done, or can't be done cheaply, or will require the development of entirely new technologies, or must be done the way they've done it over the last twenty-five years on cost-plus contracts or fixed price contracts with the option of cost over-runs for a single customer, the U.S. government, which doesn't have to show a profit.

If you've done your homework, studied the various markets, found a market that you can penetrate without being MacDac or Rockwell or Boeing (and without bashing heads with them), located customers in that market, learned what their desires are and what they'll pay, and determined that you can produce a product that costs you less than what they'll pay for it and can furthermore produce that product to meet their schedules and other requirements, you've got a business plan that bankers and investors and venture capitalists will gladly look at. *And they won't care diddly-squat about the technology behind it, especially if it's off-the-shelf hardware that's already proved it works!* Arthur Rock didn't understand the technology behind the Apple computer and didn't care how Jobs and Wozniak had designed it or what microchips they used, only what these units cost. The investors may keep the pretty full-color artist's rendering to proudly show other people what they had the foresight to drop a bundle into after it succeeds, but they won't buy the project on the basis of that picture.

When you've got the business plan, the capital, and the product nailed down hard, then you go talk to the various government bureaucrats in the plethora of regulatory agencies. They treat you with considerably more respect if you present them with a *fait accompli* in which you've already considered all the piddling little things they're going to be

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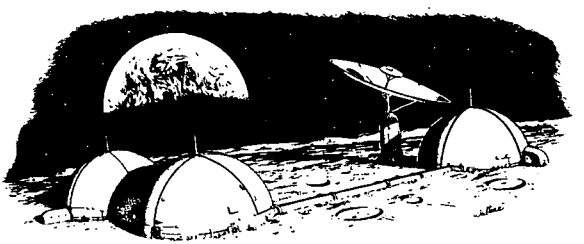
concerned about.

This is the way entrepreneurs, small companies, and even the Fortune 500 corporations do it in the real world every day. They have to.

If the two authors know so much about this, then why, you may ask, are we not out there doing something about it? Aha, would we tell you if we were? Does Macy's tell Gimbels'?

Remember the first admonition of Count Guido von Pirquet: "Get the money!" Learn how to do that the way every other successful business has, and you can laugh all the way to orbit. ■



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LAURA GUTH
CIRCULATION DIRECTOR, SUBSCRIPTIONS

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on gaming

Matthew J. Costello

Ogre is one of the games I cut my teeth on. It was a rather simpleminded affair (no offense intended) and it was packaged rather modestly. Essentially, *Ogre* (Steve Jackson Games, Box 18957, Austin, TX 78760-8957) depicted a futuristic battle between a nasty assortment of high-tech assault vehicles —tanks, Hovercraft, missile cannons—against a single Ogre tank, hell-bent on destroying the other side's command post.

And that's about it, a mechanical Goliath versus a bunch of Davids. The game was remarkably well balanced, with clever play on either side determining the winner, and *Ogre* has long been one of the SF classics. Now, Steve Jackson Games has released it in a Deluxe Edition that should win it even more friends. This Tenth Anniversary Edition takes the game out of its pocketbook-sized plastic box (cute, but unimpressive) and puts it into a hefty, standard-sized box loaded with goodies.

There are nicely detailed counters depicting the Ogre MKIII and the new, even more powerful MKV. And there are hoards of tanks, howitzers, G.E.V.'s (Ground Effects Vehicles) and battle-suited infantry. All the counters come with plastic stands. The *Ogre* game board, depicting missile craters and a desolated alien terrain, is now a mounted mapboard, a hefty item for a hefty game. It also includes on-board charts for keeping track of the Ogre's damage (he can take a lot of damage), including treads, movement capability, and weapons, a combat results table, and the combat specifics of all the other forces.

The game rules, written by Steve Jackson, have fortunately remained unchanged. The newly edited rule book includes a three-page introduction to the world of twenty-first century warfare. As mentioned, the game is simpleminded, but without being simple. During a turn, the Ogre moves, then fires. Then any defender's units disabled previously become active again. The defender then moves, fires, and G.E.V.'s get a special additional movement turn.

Each vehicle, and the infantry, get a movement allowance, attack and defense strength, and a range. The Ogre also has an allotment of treads. An MKIII has 45 treads, while the souped-up MKV has 60. As they are blown up, the speed of the Ogre is reduced. But even a totally stopped, dead-in-the-water Ogre is a dangerous thing. An Ogre is loaded with weapons, including missiles, a main and secondary battery of long-range cannons, and anti-personnel weapons. Stopping this baby from moving is only half the battle. (A moving Ogre, by the way, can ram anything in its path at the damage cost of only a tread or two.)

In the basic scenario, the Ogre must escape from the game board or destroy the enemy forces. Other scenarios introduce the idea of dueling Ogres and

(continued on page 108)

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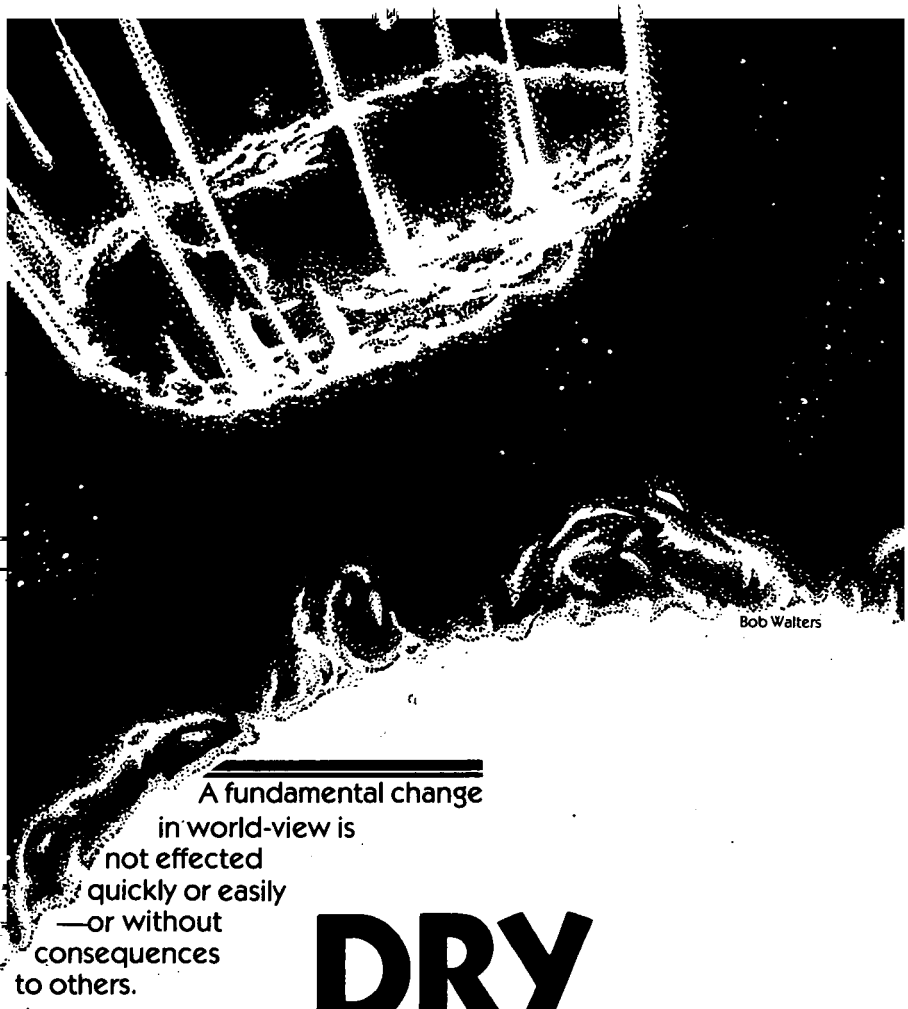

A fundamental change in world-view is not effected quickly or easily —or without consequences to others.

DRY RUN

J. Brian Clarke

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Do you love me?
I love you, Momma Gia.

That was how Emma had first confirmed her affectionate nature via secret-talk. Now, even after a further two years of intensive education and training, she remained the likeable and lively individual she had always been, although the physical transformation was startling. From a gangling, awkward youngster whose double-jointed limbs seemed designed to tangle rather than be useful, Emma had matured into a sleek, gray-furred being with a grace and suppleness which made her mentors feel awkward. The fierce pug-nosed face and fanged grin would perhaps be disconcerting to anyone unfamiliar with the Silver People, but to the humans and Phuili who were her adopted parents, Emma was beautiful. Nevertheless, the young Silver and her four sisters and one brother had known their idyllic existance could not last forever, although the break—when it finally came—was sooner than expected.

Gia Mayland had always been Emma's special parent. Indeed, the two were so close that not even secret-talk was necessary to reveal to Emma that Gia was deeply troubled. More ominous, was the fact Gia was not wearing the glove. That piece of equipment, through which Gia could secret-talk via the natural sensors on Emma's hands, was not even visible. It was as if the human did not want her meanings distorted by emotion.

"Emma dear, I have to ask the question I have not asked since I first told you about your people. What is your reaction to what the Silver People intend to do in the universe?"

Puzzled, Emma stared at the slim, dark haired woman. She understood the question and at the same time did not understand it. It made as much sense as being asked to identify the color of the blue sky. "It is wrong to destroy life. It is wrong even to want to destroy life." She meant exactly what she said. But she wished Gia wore the glove. Only with secret-talk could Emma communicate the intensity of her abhorrence.

The woman sighed. After twelve years with the project, she felt she knew the youngsters as much as any mother would her own children. Nevertheless, the six were *alien*, and despite her hopes Gia was aware there would always be unknowns.

"Emma, from the moment we determined the pregnancy of your natural mother, there was no doubt in our minds that her offspring would be brought up under the principle of absolute honesty. As soon as the six of you were old enough to understand, you were all told about the Silver People's monomaniacal determination to eliminate every form of life other than their own. It is why we destroyed their home world, and it is why we must do something about the ships they seeded into space before their sun was triggered into nova. We found one of those ships, Emma, and tried to find a way to neutralize its threat without destroying its crew. Well, you know what happened. We were forced to destroy that ship and the thousands of sentients aboard. And when it was over, all we had to show for the ghastly experience was one, nearly dead pregnant female who gave birth to you and your brother and sisters before she died. It is a terribly unhappy story Emma which, with your help, may yet have a happier ending."

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The young Silver grasped both of Gia Mayland's hands. Because the human was not wearing the glove, there was no silent communication. But the warmth and mutual pressing of fingers was a comfort. "Happier? How, Momma, how?"

"Well to start with, we have found another ship of the Silver People."

"You have? Where? When? How can I help?"

Gia said sadly, "You start by becoming grown-up."

It was almost claustrophobic but not quite. In a tiny glass-ended chamber recessed into the wall of a huge cavern at the heart of the ship, Emma waited for the signal. Beyond the transparency, thousands more of the life-suspension units studded the walls of the cavern. Each cramped cavity contained a stasis-preserved being superficially like Emma, but whose dormant brain cells contained instructions to destroy. Not to preserve.

Even with the combination of human ingenuity and Phuili science, it had been a herculean task to phase-shift the gigantic mass of the ship to a new destination. But when the radiation from the approaching sun triggered the sequences which would begin to rouse the sleepers, hopefully none of them would suspect the hoax which, in the name of sanity, had been perpetrated. Neither, it was also hoped, would they detect the presence of aliens in the hidden control center at one end of the converted asteroid.

"Emma, are you alright?" As clear as if voice-spoken, the words impressed into Emma's thoughts.

Emma fingered the implant at the side of her neck. "Yes, Momma Gia. But I am lonely."

"Until this thing is over, we will always be here. Me, Jase, your brother Silskin, David—"

"—iss to be accepted you lonely," interjected Davakinapwottapellazanzis. Preferably "David" to those without benefit of the dexterous Phuili tongue, he was Emma's second favorite parent. Possessing a sad-eyed canine head atop a squat and powerful body, a contrast in temperament as well as physical appearance to the humans he was associated with, the old Phuili had nevertheless charmed the six young Silvers almost from the moment they became aware of the beings of two other races who shared their world. David continued, "But you not old, so can accept pwoblems better zan older. And if mission succeed, you have Silver fwiends you not have before."

Silver friends. It was the prize at the end of the rainbow for Emma, and abruptly a fierce determination replaced her fear. I will do it, she told herself. I *will* do it!

And then another voice, warm and familiar. "Hand-touch," said Silskin encouragingly.

"Hand-touch," Emma replied, regretting her brother's unfortunate choice of words. She still was not adjusted to the nerve blocks which had eliminated all feeling in the sensitive palms of her hands. Hand-to-hand secret talk was an extra voice and ear for a Silver, and to lose it was analagous to becoming a partial deaf-mute. But because that unique form of communication allowed no deception, or even half truths designed to deceive, Emma's temporary

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diminishment was the only way to preserve her undercover role amid the thousands of wild ones aboard the drifting ship.

"Seven minutes," Jase Kurber announced. Kurber was one half of a relationship he and Momma Gia called "marriage." He was likeable enough, although Emma envied the closeness apparent between the two humans. "Remember Emma, you must act as if it is a complete mystery to you why Control reactivated a lower priority person such as yourself."

"Yes, Poppa Jase." Emma stretched as much as she could within her claustrophobic confines and tried not to stare too hard at the ruby indicator above her head. Somewhere on the asteroid-ship's surface a detector had already locked on to the nearing star and was waiting for penetration into its circum-solar life-zone before generating the signal which would begin to reactivate up to a dozen of the sleepers. Based on past experience, the number of reactivations could be as low as two, although analysis of the control sequences had raised the possibility that no two Silvers' ships were alike either in physical layout or programing—adding an uncomfortable element of uncertainty to each encounter.

The indicator began to blink; once, twice, and then urgently. It was a simple warning signal, telling Emma that far more involved processes than a blinking light were proceeding in other chambers. She cracked open the lid, holding it back against spring pressure until she could see which of the other chambers were activating.

At first she saw nothing, although the slightest flicker of light would be a beacon in the stygian darkness of the cavern. She opened the lid a little further and wriggled her body outward so she could peer over the rim of her chamber. Almost instantly she saw it; a spark only meters above her head. There was another glimmer, to the right and dimmed by distance. And then, starting from a point at the top of the cavern and cascading down its sides like an incandescent flood, the main lighting system waxed to full brilliance within seconds; revealing thousands of glass-lidded stasis chambers glittering like huge jewels set in the rock.

From the chamber above Emma's, a lithe figure floated free, swiveled and grasped a handhold. Like a butterfly resting after emerging from its chrysalis, Emma thought, although the delicate winged creatures she knew only from books and instructional tapes hardly resembled the bedraggled humanoid clinging to the wall.

"Jihevva!" the Silver said suddenly, and with a powerful thrust of its long legs launched itself upward towards where another Silver was just emerging. Still only half way out of its chamber, the second Silver shouted something and pointed across the cavern to where two other Silvers were poised near their open chambers. More shouts were exchanged, until the first two Silvers leaped across the huge space, turned in flight and landed neatly adjacent to the others.

Emma said excitedly, "There are four! They have rendezvoused across the cavern from me."

"Then it is time to show yourself," Gia Mayland instructed from the con-

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cealed room less than two hundred meters away. The human added, with a concern which warmed Emma's heart. "But be careful, dear. Please."

"Yes, Momma." Emma let go the lid of her chamber, and as it swung wide she shouted, "Hello!"

The reaction was silence, as the four swung about and stared in her direction. Although Emma's training was alien, the physical instincts she had been born with were sound, and she launched herself across the cavern and alighted close to them with unerring ease. "Hello," she repeated, meeting their puzzled faces.

Finally one spoke. "Who are you? Control was not programed to revive any other."

"I am Berein," Emma replied, using a name her mentors had extracted from the records of her mother's ship. She shrugged. "I do not know why I was chosen. I am only a Priority Eighteen."

"An Eighteen?" One of the Silvers reached out and grasped Emma's hand. The large eyes widened with astonishment. "No wonder. You are a lesser!"

They clustered around Emma, touching and stroking her. They were friendly, sympathetic, showing a positive side of the Silver character completely at variance with their attitude to other life forms. "Obviously Control erred," said the one who had attempted secret-talk with Emma. She pointed at herself and then at the others. "I am Gelhon and this is my mate Bewokul. That is Jihevva and his mate Halranen. But now—" Gelhon turned towards a large opening in the upper part of the cavern. "—our immediate purpose must be to find out why we are here."

As if with one thought, the revived Silvers floated up to the opening. Emma followed meekly behind. The opening was the inner end of a tunnel which drove arrow-straight to the asteroid's surface, but half way along Gelhon turned aside and led them through an armored portal which opened automatically at their approach. Beyond, was a large room crammed with panels and indicators. Gelhon stopped part way into the room and said loudly, "Control?"

CONTROL, acknowledged the computer. Containing neither gender nor expression, its cold machine voice made Emma's fur crawl.

"State reason for activation of life units."

VEHICLE APPROACHING TARGET SYSTEM. INDICATION OF LIFE BEARING PLANET IN INNER ZONE.

There was a hiss of indrawn breath. "State degree of infestation," Gelhon ordered.

DATA INSUFFICIENT.

Ignoring Emma, the four Silvers grasped hands and for several seconds stood in silent communication. It was the first time in her life Emma felt truly left out, and in desperation she called, "Momma Gia!"

"Emma, what is the matter?"

"We are in Control. The others are using secret-talk."

Gia understood. "You knew that would happen. Have you any idea what they are discussing?"

"I only know the computer has told them about the life-world in this system."

"We heard that, and it was expected—or at least hoped for. Consid-

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ering how difficult it was to reprogram that electronic juggernaut of theirs—"

Emma abruptly broke contact as the four released hands and Gelhon came to her. "Berein, we do not wish to be unkind but important decisions must be made. You heard Control. I hope you understand."

"Yes, Gelhon, I do understand. You will tell me what I cannot sense?"

"We have already decided to activate a full echelon. The Ark is not yet close enough to that world to know how much of its surface is contaminated, but we do know that a minimum of fifty scouts is necessary to sterilize even a small continent."

Emma sub-vocalized, "Momma, did you hear?"

"It is being recorded, Emma. Just remember the special place you hold as a 'lesser.' Normal Silvers look on those without the ability to secret-talk as some human cultures do their blind—as people compensated with a wisdom not held by the sighted. It is a delicate edge you tread my dear, so be very cautious what you say or do."

Part of Emma's training had given her the ability to communicate through her implant while outwardly carrying on a separate conversation or activity. It was an asset which gave her an objectivity she could apply to either side at will. This time she was applying that objectivity to what was going on around her, as the one called Jihevva approached a big panel at the end of the room. The panel was divided into an orange and blue section, each glowing with thousands of illuminated indicator buttons. Jihevva began pushing the buttons until twenty-five pairs of them were flashing orange and blue. He nodded with satisfaction. "We will wait for our brothers and sisters in the Instruction Hall."

That was a large, vaulted chamber which they accessed by following a smaller corridor paralleling the main tunnel. Although Emma was as familiar with the interior layout of the gigantic vessel as any of her crew, identification was another matter. She had to avoid the situation in which she would be expected to know the location of any place by its name. Emma communicated her unease to Gia, who replied warningly, "You must anticipate such traps. If necessary, feign illness or find an excuse for one of the others to accompany you. But never arouse suspicions by admitting ignorance."

It was sound advice, and Emma felt comforted by the fact that those who had always been closest to her were still—even in the literal sense—within reach. A little more relaxed now, yet conscious of her role as a Silver of lowly status, she remained silent and separate as her new acquaintances huddled together and communicated with a mixture of voice and secret-talk.

If Emma knew anything at all, it was the absolute certainty that the Silver People's dedication to the destruction of all life was an obscenity almost beyond belief. So why was it she felt strangely attracted to these mirror images of herself? Did it mean that even a lifetime's indoctrination cannot thin the call of the blood? Not according to Poppa David, she remembered, who had often remarked in his profound Phuili way that "a body is not more a person zan a house is who lives inside." Certainly Emma had never thought of

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her human and Phuili mentors as anything other than persons, even considering their obvious physical differences. On the other hand, was it possible that was an exception rather than the rule?

Prejudice, especially of the racial kind, was a subject not taught or even discussed in the small planetary colony devoted to the upbringing of six young Silvers. But the colony's data-base contained a reservoir of knowledge culled from the libraries of two planets, and over the years Emma's innate curiousity had caused her to accumulate an incredible clutter of unrelated facts—including a chilling item about one human response to race difficulties as expressed by the word "genocide." The human race had, of course, long since evolved out of that dark period of its past. But if Attila, Hitler, Karel Hewton or any other of those charismatic demagogues had had the ability to lead their followers into the galaxy, would they have been any less deadly than the Silver People? In fact, not even the history of the Phuili was entirely free of—

I am rationalizing! Emma shuddered as she realized the traitorous potential of her thoughts. Evil is evil from any source, and must be expunged. By peaceful means if possible. By the destruction of worlds if neccessary. Morality never involves an easy choice.

She started as a furry hand touched her shoulder. "They come," Gelhon said solemnly. Emma turned and looked to the entrance of the room as pair by pair they came in, twenty-four couples and a lone female. The female was in a state of crisis, twisting her head back and forth and moaning, "Kapakan is not! Kapakan is not!"

"She found her mate dead in his chamber," Gelhon whispered as the female was calmed by a sequence of reaching, soothing hands. "It must always be thus. The system is not perfect."

Emma touched her implant and switched to the symbolic shorthand she and her siblings had developed after they received the tiny units. The mentors knew of the shorthand and had, indeed, encouraged it. From the start, it had been realized that hand-to-hand secret-talk was merely the physical manifestation of something much more complex inherent in the Silver brain. The implants had proved the theory, giving the young Silvers the ability to communicate at lightning speed with each other, as well as at a normal rate with the mentors themselves.

Silskin!

Emma!

From this moment I cannot use time by talking normal with the olders. Tell them you are henceforth their channel to me.

I will tell them, dear sister.

It did not have the warmth and closeness of secret-talk of course, but at least it was an exclusive link with her brother. In any case, Momma Gia and Poppas David and Jase could still hear what her ears heard. They did not need Silskin for a running commentary.

One of the newcomers called for attention. He was a large male with grizzled fur and pale, glittering eyes. "I understand we are approaching a world which needs cleansing. But that we are not yet close enough to know if the Holy Task can be mounted with a minimum of effort."

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Jihevva nodded. "That is correct, Master Delbroj."

"What is the status of this Ark and its crew?"

"As expected, we had meltdown of the main drive and the Ark is drifting. All other systems are functioning, including the stasis generators. Generally, I believe we are healthy, Master Delbroj."

"As the Giver wills," the old male said solemnly.

It was a strangely fatalistic reaction to the news that their ship had become an inert wanderer, captive to the same gravitational laws which governed the movements of planets and suns. But Emma was not surprised. The primitive one-surge drives of the Silvers ships had been barely sufficient to phase-shift them half a light-year towards their respective target suns, even as their own sun was triggered into nova by human-Phuili action. Nevertheless, although the Silvers were the ultimate xenophobes, they were not so mad as to permit their seeds to die a lonely death in the interstellar void. Crews could be preserved in stasis until the end of time if necessary, and the thousands of tiny space-scouts encrusted like barnacles on the surface of each ship, were themselves capable of ranging across light-weeks of distance. It was why the fifty or so giant carriers which were known to be spread across the surface of an expanding sphere a light-year across, were potentially a worse threat than that once posed by the billions of Silvers who had been alive until their planets were incinerated.

Unless . . .

Emma and her siblings were the alternative. They were Silvers, in blood and flesh and bone exactly as those on the ships. But their dedication was to life, not to its antithesis. If the wild Silvers were to be diverted from their deadly crusade, it could only be by others of their kind. It was a task many Phuili and humans were convinced was impossible—who were in fact resigned to the unpleasant necessity of having to vaporize each Silvers ship as soon as it was found. Nevertheless "Project Alchemy" was secretly established to raise and educate the six baby Silvers. The Project was a desperate attempt to expurgate some of the guilt resulting from the horror of the preemptive strike which had destroyed almost an entire race. It was also an incredible burden to place on six young shoulders, and no one knew it better than the six themselves. But they were proud. Above all, they were willing.

It had become quiet again in the Instruction Hall as most of the Silvers disappeared to perform tasks for which they had been trained before they entered stasis. A few, Emma suspected, would soon be suited up and out on the surface, beginning to prepare some of the deadly little scouts to receive cargoes of radioactive poison to be dumped on any target which had even a suspicion of reproductive life. Why are they like this? she wondered, in her innocence still doubting what her teachers had told her of the evolutionary history of the Silver People—of the legions of savage carnivores ranging from insectiles to thirty-meter monsters which the evolving sentients had had to conquer and destroy just to avoid being destroyed themselves. A genetic hate, Poppa Jase had called it.

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Those who remained, including Jihevva, Delbroj, the grieving female who was called Felwon, and Emma herself, returned to Control. Felwon, learning of the other single female's "handicap" and realizing this was a fellow misfit, stayed close. *If only she knew the whole truth*, Emma communicated wryly to her brother.

Cultivate her, Poppa David came back through Silskin. *That kind of depressed mental state makes her a possible convert.*

It was a good suggestion, if a doubtful one. It had, after all, taken a lifetime's training to enable Emma to win over her own call of the blood. Nevertheless, it was one of the slim possibilities she could not ignore.

Emma's attention was jolted by a bellow from the one they called Master. "It is not possible, I tell you! The star pattern is all wrong!"

Jihevva had activated an optical pickup, and he and Delbroj were staring at a big display panel. Compensating circuits had blanked out the glare from the central sun enough to display the background stars. "In the Giver's name, I should know," the old Silver continued angrily. "I was the one who originally selected our first target, and I tell you this is not it!"

Looking doubtful, Jihevva turned away from the panel. "Control."

CONTROL, acknowledged the computer.

"State time since initial activation of the main drive system."

THIRTY NINE YEARS, FORTY THREE DECIMAL SIX DAYS.

Actually it was less than seventeen years. But the human and Phuili specialists had done their work well, reprogramming Control as well as diverting the millions of tons of mass to another system. Unfortunately no one had anticipated the photographic recall of an elderly Silver.

"Are we on course to Prime Target?" Jihevva asked.

NEGATIVE.

There was a hiss of indawn breath. Delbroj chuckled nastily. Emma waited. There was still a question to be asked.

"How far are we off course?"

MINUS DECIMAL ZERO ZERO THREE DEGREES.

"But that is nothing to . . ."

MAIN UNIT WILL PENETRATE CHROMOSPHERE OF TARGET STAR IN THREE ONE ZERO DECIMAL EIGHT DAYS.

"What?"

The die was cast. Emma expelled air in a long sigh, outwardly as horrified as the others, but reacting for an entirely different reason—the knowledge that the incentive was finally in place. She envied as she watched the others, including Felwon, agitatedly secret-talk. Her own palms tingled from the irritation of the nerve blocks. *Now they know*, she signaled.

That is obvious. From this moment your real work begins. But be careful of the old one. His attitude is unexpected.

So was Felwon's. Her expression calm, almost ethereal, she came to Emma and said dreamily, "It seems we are destined to burn. Even as billions of our brothers and sisters were burned by the sun under which we were all born. Do you not think that is poetic, Berein?" Felwon gently touched Emma's

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cheek. "You are a lesser. I lost my love. What can be better for us two than to welcome the end of our pain?"

"No!" Unceremoniously grabbing the female's arm, Jihevva swung her to face him. He was angry. "Three hundred and ten days is not tomorrow, and in any case our lives are not ours to waste with useless moaning about what cannot be changed! Do you understand me?"

"Yes, Jihevva." Like the switching of a circuit, Felwon abruptly withdrew from the edge of insanity and was contrite. She hung her head. "You are right. Therefore I am wrong. Our holy purpose must always come before our feelings."

Emma marveled at the discipline. To be able to order someone back from the mental brink and be obeyed was, she knew, something uncommon in both Phuili and human experience. Despite herself, she warmed at the knowledge she was also of this species.

Gia Mayland signaled, *The female's concern with feelings is a good indication of where she is vulnerable. I suggest, dear, you take advantage of that vulnerability.*

Yes Momma, Emma agreed, not liking the callousness of the suggestion but realizing the situation was one in which the end did truly justify any means.

Then it was David. *Emma, it is through you the people on that ship are about to be presented with an impossible dilemma. We Phuili were also once faced with such a dilemma, and you know how we solved it. Use that knowledge.*

I will, Poppa David, Emma replied, appreciating the old Phuili's reminder that the Silver People's obsessive hatred of other life forms shared, in many respects, the instinctive knowledge that the Phuili had of themselves as being the indisputable heirs of the universe. It was the coming of the humans, a race which in the ridiculously short span of a few centuries had advanced from the wheel to interstellar travel, which had threatened to shatter that prime tenet of Phuili belief and culture. But the simple device of acknowledging humans as "intelligent animals" had preserved the ancient equilibrium, albeit with the reluctant agreement of the humans themselves. It was a compromise, Poppa David had told his young pupils, in which the impossible had been reclassified as "improbable"—permitting a cooperation which, to the profound surprise of everyone, proved superior to the sum of its two parts.

Solidly anchored to the rock of his own conviction, Delbroj seemed unaffected by the computer's prediction of disaster. Into the embarrassed silence which followed Jihevva's denunciation of the mateless female, the Master repeated softly, "I still do not believe it. That is the wrong sky."

Johevva tensed, clearly on the verge of arguing the point. Instead, in a partial sidestep, he asked, "Are you willing to concede there is an infested planet out there?"

Delbroj hesitated. "Not absolutely." Then, grudgingly, "But I agree we must investigate further. Even if we are in the wrong system."

Emma wished the old one would go away. His stubbornness in the face of overwhelming evidence was beginning to worry her. She prayed the human-Phuili teams had not missed anything

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in their reprograming of the computer. Even the slightest evidence of external manipulation and consequently of other intelligent life, would be fatal to hopes of diverting this ship load of Silvers away from their savage purpose. It was fortunate that Delbroj's title "Master" had no official status other than signifying respect for someone of long experience. Jihevva, as a first-roused, was the one with authority.

Again, Jihevva spoke to the computer. "State degree of life-infestation on planet in inner zone."

The odds were that not enough time had elapsed since Gelhon had asked the same question. But the line between negative and positive is often narrow, and in this case the line had clearly been crossed. PRESENCE OF CHLOROPHYLL AND ATMOSPHERIC OXYGEN INDICATIVE OF VEGETATIVE LIFE FORMS, the computer replied. There was a pause. Then, as if with an electronic afterthought; APPROXIMATE NINE ZERO PERCENT PROBABILITY OF REPRODUCTIVE ANIMAL FORMS.

"Keduhunna!" Jihevva turned to Delbroj, and in unison the two males repeated the ancient call to exterminate. "*Keduhunna!*"

Timidly, "Berein" asked, "What happens, after?"

That startled them. Even Felwon seemed astonished. The Master, who had ignored Emma until now, stalked over and took one of her hands. He nodded. "As I was told. A lesser."

Emma steeled herself. "Master, does it serve our holy cause to die in the fires of a star? That is only one world. And we are enough to cleanse many."

Delbroj gently laid a large hand on her head. "One bridge at a time, little one. First we will do what we must."

"Then can we leave the ark before it burns and go down to that world? Perhaps stay there long enough to find another space rock we can make into a new ark? Control has said there is air for us to breathe."

The old Silver was patient. "Air is only part of what we need. We must also have food and water. I know that world has water, but after our work is done there, would you want to eat the rotting matter of once-life? For you, little one; for me and for all of us, far better a clean end in the solar fire." From sympathy, Delbroj's expression darkened to anger. "One world only. *One* world! If we were on the proper course, there could have been many on which to continue the Giver's work. Hundreds. Perhaps thousands!"

Despite her nervousness at the old one's continued persistance, Emma was satisfied. She had planted the seed which sooner or later would force her listeners to confront the obnoxious option. And she was certain they would not be able to keep it to themselves; secret-talk would inevitably spread the idea like a wildly communicable disease. The key, even for a people as fanatically dedicated as the Silvers, was in that all-encompassing human phrase, "The proper rationalization."

Emma slept poorly that night, despite the approval communicated from her mentors in their hidden chamber. Felwon had chosen the neighboring cubicle, and her frequent whimpering made it difficult either to relax or concentrate. In fact, Emma was beginning to have

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doubts about Felwon's potential value. Despite the apparent death-wish reversal, it seemed too much to expect a turnaround—especially to the extent the female would subscribe to the option. Grief is an emotion which is not so easily exorcised.

Eventually, Emma did slump into a fitful sleep in which her dreams proved almost as exhausting as real-life. Her subconscious conjured up disturbing images of friends and enemies in which neither could be distinguished from the other. Humans, Phuili and Silver People merged, separated, fought and loved with complete interchangeability. Familiar faces, some on not so familiar bodies, welcomed, accused and hated with a gallery of emotions and expressions passing through her awareness like random ghosts. And when Emma finally woke, it was to a cacophony as confusing as her dreams.

It was as if the ship had become a hive of ants, with scurryings, shouts, and indeterminate noises around, above and below her. Still half asleep, Emma murmured, "Momma."

"Hush," Gia Mayland said through the implant.

"Wha . . . what is happening?"

"I don't know. But I would not be surprised if there have been unauthorized awakenings. Perhaps you can find out at Control."

"I will go there." But first Emma checked the next cubicle and saw that Felwon was gone. The single sheet from the female's bunk was bundled and tossed aside. The corridor which connected the row of cubicles was thronged with dazed Silvers; talking, wandering and hand-touching. Emma pushed her way towards Control, trying to ignore the groping hands, only half hearing the plaintive questions which averaged out to, "What is happening? Why am I here? Why are so many here?" The entrance to Control was guarded by two large Silvers, each armed with a hand projector and a pair of long, wickedly curved knives. Emma was about to be thrust back when someone called from within the partly open portal, "It is all right. Let her pass."

There were at least a dozen inside, including the first four. Felwon was crouched in a corner, curled almost in a fetal position. A bloodied, dead Silver was crumpled near her. At the far end of Control, all but a few of the indicators on the orange-blue panel were flashing in unison. Gelhon saw Emma's widening eyes and nodded. "That's right, Berein. This—," She poked Felwon with one foot, "—came in here, killed the guard and then activated most of the sleepers."

Emma caught her breath. "Why?"

"Because she is obviously mad," Halranen declared. She added flatly, "Felwon has killed us all."

"We are going to die anyway." Jihevva gestured at the big screen, on which the sun was already showing a perceptible disc. "The only difference, now, is that everyone will know it."

Bewokul chuckled. "Consider the bright side. With three thousand scouts and nine thousand people to crew them, we can sterilize that world a dozen times over." He shrugged. "And why not? There is nothing else we can do."

Felwon stirred and raised her head. Her eyes were wild, unseeing. "You can live," she whispered.

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Emma was glad to be away from the ship's teeming interior. She was not so happy about being out of touch with her mentors, although during the few moments she had before she boarded the scout, Poppa David had told her she should welcome this opportunity to continue what Felwon had so surprisingly started. "She hate because she alive when want not to be so," the old Phuili suggested. "Zerefore she make evewyone awake so zey can see sun and know zey will burn."

So a sane mind explains a deranged one, Emma reflected as she watched the blue-brown landscape below the scout. Her moody introspection was disturbed by a single explosive epithet by the scout's pilot. "Life!" Jihevva was glaring out at the rolling grasslands and occasional clumps of bush. "Just look at that. The whole planet is contaminated!"

In fact it was not a particularly verdant world. In the grip of an ice age, it had huge ice caps extending to midlattitudes. Only in the equatorial regions, on the single continent and a straggling archipelago, was there an ecology which supported spare savannas and widely scattered subarctic forests. Nevertheless, it was clear Halranen shared her mate's distaste.

"I have seen enough. Please take us back to the ark."

Emma had been raised on a world not too dissimilar from this one. Pacific's oceans were larger, its climate milder, its land-based vegetation a little lusher. The indigenous animal life was widely scattered and timid. So unremarkable was Pacific, with so few potential distractions, it had been selected as the ideal location for "Alchemy," the project dedicated to raising six young Silvers to a true respect for all living things. But as she looked at the retreating surface of this other life-bearing sphere, Emma wondered if Pacific had been the right place for her education. *I have seen enough images of the abundant worlds of Earth and Phuili to love and respect the vibrant force which is life. Yet how can I communicate to these brothers and sisters of mine what I have only indirectly experienced? It is so difficult!*

One thing, however, was certain. With her current captive audience of two, there would never be a better opportunity to begin. "It makes one wonder," she muttered, as if to herself.

Halranen turned in her seat. "Wonder? About what?"

"Sorry. I was thinking aloud."

"Compared to most of us, I suppose you do have more time to think about things. I mean, considering your—ah—impediment." Embarrassed, the female went on, "What is on your mind?"

Emma shrugged. "I just do not understand why we must all die after the decontamination of one small world. The Giver made us to purify galaxies, not to expend ourselves on a dust mote."

That startled Jihevva, who locked the controls while he turned and stared at the passenger. "Berein, you cannot know what you say, otherwise I am sure you would not say it!" His tone softened. "But of course, you do not understand. The Ark is destined to plunge into the sun of this system, and nothing

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we can do will change that. So we must use the one small opportunity presented to us, and then prepare to die. It is that simple."

"Forgive me please, but I do not believe that is so. It seems to me there is at least one other option."

Emma knew she was treading on thin ice. She also knew she could push the limits of propriety a little further than would be accepted from a "normal" Silver. But how much further? Praying she would not have to resort to extreme action, she tongued the tooth switch which armed the deadly little needle weapons concealed under the retractable claws of both thumbs.

Jihevva had returned his attention to the controls. The scout was above atmosphere now, and he opened the homing dish from its recess in the hull. The dish swiveled, and within seconds locked on to the ark's signal. The drive thrummed, they were thrust back against their restraints, the planet dropped away into the darkness. The male did not look at Emma, but tension was evident in the manner he grabbed his mate's hand. "What option?"

Emma took a deep breath. "Instead of decontaminating the planet, we use what is there to survive until we can refit another ark and continue our mission. Each scout cannot carry much, but because there are many, we should be able to transport enough material to give us a start with—"

"Just a moment," Halranen interrupted. "Use *what* to survive?"

"Protein."

"Of course, protein!" Halranen said crossly. She started to say more, but the words caught in her throat. Horrified, both she and Jihevva turned and stared at the defiant one in the back seat. If the male had been a human, Emma was sure he would be livid. "You dare to suggest we use—," He almost choked, "—*living* matter?"

"It is protein, isn't it?" Emma insisted with feigned innocence. "Synthesized or grown, why should it make a difference? Instead of destroying it, we make use of it. And survive. And ultimately continue our holy mission."

For Emma it was the final, absolute commitment. What happened during the next few seconds would be the making or breaking of Project Alchemy and the hopes it stood for. If wild Silvers could not be turned from their deadly crusade, they would be destroyed. Jihevva and Halranen would be the first, instantly paralyzed and then dying as the virulent poison from Emma's needles acted on their nervous systems. Then the Ark itself, vaporized along with the thousands of sentients aboard her. And every other ark, as soon as it was found, without hesitation and certainly without mercy. And because civilization is the ultimate expression of the life force, that genocidal precedent would trigger a guilt which for generations would haunt the collective psyche like a malevolent and unexorcisable spirit.

All this passed through Emma's mind as she prepared for the worst. It was a tribute to a combination of training and rigid self control that she did not react when Halranen suddenly screeched, "It was what Felwon said! We can live!"

"*No!*" The male pulled his hand away from his mate in shock, for a moment also unknowingly on the brink

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of termination. He shouted back, "Felwon was wrong! Berein is wrong! Better to die!" Again the two clutched hands, and in silent yet violent communication they strained like two arm wrestlers. When they separated, both were in a state of near collapse.

"We can live," Jihevva said dully.

"Yes." Halranen turned to the unparticipating passenger with an expression which was a compound of relief and accusation. "You had better be right, Berein."

It was only a battle, yet for a moment Emma felt she had single-handedly won the war. She was uncertain what had happened, except to suspect that in Silver terms Halranen and her mate had become insane. In a greater sense they were perhaps the first of their race to find true sanity—except that particular hope was dashed when Jihevva explained, "It is a sacrifice we must accept so that we or our descendants can continue the Great Work."

Sensing that for the moment further words from her would be superfluous or even counter-productive, Emma nodded silent agreement. She would like to have known how Jihevva and Halranen proposed to persuade others to the new doctrine—or even if they had a plan at all—but instead had to wait with lonely anticipation as the two communicated only via secret-talk until the scout finally reberthed on the Ark several hours later. As they entered the crowded tunnels, Emma was met by two guards who promptly escorted her to a restraining cell.

She could not believe it was happening. "Momma," Emma sub-vocalized plaintively as the door slammed shut. She tried to open the door, but it would not budge.

Silskin answered. *Emma! What has happened? Are you alright?*

No, I am not alright! I want to talk to Momma Gia!

There was a pause. Then; "Emma?"

"Momma, what is going on? They have locked me up!"

"I know. I don't understand it either. Emma, what happened between you and those two while you were away?"

"I wish I knew. Jihevva and Halranen *said* they accepted the necessity of surviving on that world. But how can I be sure? I don't have secret-talk!"

"They had a rationalization, I suppose?"

"Only what I gave them. That the end justifies the means."

"Really? In that case, Emma, you have made real progress!"

"I am glad you think so. But it hardly explains why I am in this cell."

"Just a moment, dear." There were several seconds of silence, during which Emma agonized with a mixture of hope and doubt. Then,

"You may not believe this, but your two friends are walking through the Ark like glad-handing politicians, greeting everyone in sight! It's as if—"

"Momma, I think I know! They're passing on the message the best way they know how. Don't you see? If they had left me free to blab, I could have spoiled it all and probably got myself killed as well—and believe me, murder was in the air when I ever-so-gently made a few suggestions in what I thought was a controlled situation."

"You could have defended yourself. Your stingers—"

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"If I had used them, what then? Jihevva and Berein are our best chance. Our *only* chance."

The conversation was interrupted by Jase Kurber. The human sounded excited. "Emma, I think your friends are returning for you. They seem in a helluva hurry!"

Then another voice. "Cwisis is dweeloping."

"Poppa David?"

Emma wondered if there was an equivalent to "emergency" in the Phuili's lexicon, as the old teacher calmly told his pupil, "One known as Master has led many into ozer part of ship, away fwom zoze who stay wiz your two. I not know meaning, but zink may be sewious."

The door opened and Halranen came into the cell. Jihevva remained outside, restraining a crowd of curious Silvers. "Come," the female said, thrusting Emma into the corridor. They followed Jihevva towards Control as with fists, feet and occasional angry snarls he rammed a way through tunnels made hot and humid by too many bodies in too cramped a space.

Control itself was hardly less chaotic, although it was less crowded. Emma saw Gelhon, Bewokul, and—astonishingly—Felwon, who was engaged in a shouting match with the screen image of Delbroj. The Master was equally strident as he shouted back, "You blaspheme! It is our holy duty to destroy filth, not to become filth! Something evil has diverted us to this place and has twisted you and the others away from the true path." The grizzled face became menacing. "You have a choice. Join us and die in glory. Or oppose us and die in shame."

As the screen went dark, there was a collective sigh which was almost a moan. Emma went to Felwon, who welcomed the newcomer with a sad smile. "Yes, I was mad. I killed because I was mad. But I was right when I revived the sleepers, because now the truth is known to them all."

Emma marveled at the resiliency of the one she had thought was hopelessly insane. "You are not being punished for what you did?"

Felwon shrugged. "I am still here. Everyone knows that is punishment enough."

It was an enlightened reply which, considering what Emma had already learned about these contradictory people, she did not find particularly surprising. "What was the argument with the Master about?"

"He said we are flouting the Giver's law."

"Aren't we?" Emma asked daringly.

"Perhaps." Felwon's gaze was clear and direct. "But as one who has flouted that law already, I don't really care."

"Felwon is a seed." Unnoticed, Gelhon had come up behind Emma. Emma felt her hand grasped as Gelhon continued, "You, Berein, are also a seed. The appearance of both of you at the same time can only be the Giver's work, or the new ideas could not have born fruit." Emma sensed an unintelligable ripple of palm muscles and sharply pulled her hand away.

"Please do not do that."

Gelhon nodded sympathetically and moved aside. "For a proper cleansing, it makes no sense to uselessly expend

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all the cleaner on one soiled spot—a concept which I find quite elegant now that I have got over the initial pain of understanding." Looking at the blank viewscreen, Gelhon added resignedly, "It is unfortunate that so many have refused to confront the pain."

"You mean those with the Master?"

"Delbroj is dangerous. Although he is wrong on the matter of whether or not we should survive, too much of what he has said makes sense. Especially his insistance that we have arrived at the wrong solar system."

That shocked Emma. She was not tuned to Momma Gia and the others, but she knew they had heard and could imagine their consternation. "But I thought Control—"

"There is evidence."

Felwon nodded vigorously. "I will get it." The younger female ran to a nearby console and returned with a large book. "These are star charts which were drawn before the Ark was launched." She opened the volume and pointed. "That is the area of space in which we are supposed to be—but in which we are not."

It was a development which was totally unexpected. The experts who so successfully reprogrammed the Ark's computer, had not even considered the possibility the Silver People might still depend on this archaic form of backup. But Emma's nimble brain quickly came up with an appropriate objection. "Why should that be so surprising? The Ark was launched, after all, even as our planets were burning. Systems were new, untried—"

"These charts show the sky as it would appear from every destination we could possibly reach during the years since drive activation. Not one matches the pattern which exists at our present location."

Emma felt helpless. She did not know what to say. Silskin signaled: *Tell them it must be the Giver's work.*

Too easy, she shot back. *They are not so unsophisticated that they blame their god for everything they don't immediately understand.*

"Zen be as unknowing as zey," suggested a familiar voice. "Zere is not way zey can know twuth."

As always, it was the Phuili's cool voice of reason which brought Emma back from the edge of panic. She longed for a few moments during which she could retire into a quiet corner and converse normally with the members of her support team; especially with Momma Gia. But events were moving too fast; she knew that even her exclusive "shorthand" channel to Silskin would have to be used sparingly. For a brief moment her imagination penetrated meters of solid rock to where her three friends and only brother were watching, listening and—as much as she—hoping.

Emma turned to Gelhon. "So what do we do?"

The older female gestured to where Jihevva had climbed on a chair and was calling for attention. "We listen to him." Bewokul came through the crowd to her, and Gelhon reached for and grasped her mate's hand.

As the noise died down, Jihevva shouted, "Are we agreed on survival?"

The response seemed unanimous, although to Emma's trained ears, not entirely enthusiastic. "Yes!"

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"It is the Giver's will," someone echoed solemnly.

Jihevva nodded. "We know the price and we know it will be a heavy one." His voice rose. "But for future glory, are we willing to pay that price?"

There was a hesitation which was barely noticable. Emma supposed she would similarly hesitate if she was told her survival depended on sustenance she could only find in a decaying heap of refuse. And her distaste for rotting protien was mild compared with these peoples' abhorrence of *any* matter which was life-originated.

"We are willing to pay the price," Bewokul said quietly, and there was a murmur of agreement. He added, "But for the sake of our sanity, I suggest we do it in easy stages. First, survey the planet for a relatively lifeless area on which we can locate our first settlement. Second, transfer as much foodstuff and equipment as possible until proximity to the sun finally forces us to evacuate everyone from the Ark."

Jihevva pulled lips back from his fangs in a savage grin. "And then the hard part, eh?"

Bewokul nodded. "For the first time since enlightenment, we will ultimately be forced to eat what is not synthesized. It will be—ah—" Bewokul's expression became as savage as Jihevva's. "—difficult."

Emma lifted her hand. "You must still deal with the Master and those who followed him," she pointed out. "They will certainly try to stop you." *And they will succeed*, she thought as she considered the inevitable stalemate; half of the crew prepared to rewrite the rules in order to survive, the other half prepared to die in the service of the unholy and unforging god they called the Giver. Neither side would permit the other to gain access to any of the little ships on the Ark's surface, until ultimately the system's sun imposed its own fiery solution. Emma took a deep breath. "Permit me to go to Master Delbroj and talk to him."

Jihevva was not the type to waste words. "Is it worth the risk?"

Emma shrugged. "I am a lesser. He will not harm me."

"It is possible you overestimate his adherence to the old ways."

"Perhaps." Emma added stubbornly, "But can it do harm?"

Jihevva studied her. Then he nodded. "Only to you, I think." He lifted his head. "Does anyone believe Berein should not try?"

The answer was silence. Still in silence, there was a general movement clearing a path between Emma and Control's portal. Feeling truly apart, for the first time as much alien as if she was human or Phuili, Emma acknowledged the quiet acquiescence and walked between the silent ranks. At the portal, she turned. "Please tell Delbroj I am on the way."

"He will know." Jihevva raised his hand, palm outward. "Good talk, little one."

Transmitted by a wave of touching hands, news of Emma's mission preceeded her along the tunnels, and only after she entered the deserted sector between the opposing factions did she feel she could pause and catch her breath. The sadness and silent sympathy had stifled her; desperately she needed a hopeful word. "Momma?"

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"We heard, Emma. And we understand why you do this. But the one you call Jihevva is right. You take a great risk."

"To do nothing is to guarantee failure. Momma, you must know that!"

"Of course I know. Unfortunately we may have an even worse problem."

What was worse than everyone frying because of forced inaction, Emma could not fathom. "What problem?"

"Delbroj. He has crews poking around this section of the asteroid. They are using charts and measuring tapes."

"Looking for what?"

"Us, obviously."

"But that is impossible!" Emma felt a sudden fear. "Unless—"

"No dear, it was not you. Somebody found something Delbroj has identified as not belonging on the Ark, and now he is sniffing around like a cross between Sherlock Holmes and a bloodhound. So right now your immediate priority must be to find out what is going on and somehow defuse it. If this hideaway of ours is found, it will not be just three aliens who will end up as chopped meat. One look at Silskin, and Delbroj will know enough to bring everyone back to his side—and heaven help any other Silver who is 'odd'. It'll be more than just your hide, Emma."

Emma thought of the two "reengineered" scouts on the surface directly above the concealed command post. "I think you and the others should leave, Momma."

"No. Not yet. Not only will a couple of unauthorized launchings help confirm their suspicions, but we four have by unanimous vote elected to remain here until you can come with us."

"I am not sure—" Emma paused. "You will not take unnecessary chances?"

Jase Kurber: "We love you, but we are not suicidal. If we have to go without you, we will. But please work things so we won't be forced to make that decision. Okay?"

"I will try, Poppa Jase." Emma rose to her feet and stretched. "Here I go, dear ones. Please wish me luck."

"Save all, daughter," David said gravely.

Silskin: *Hand-touch.*

"Come back," Momma Gia whispered.

Initially, Emma's arrival in the master's territory was almost anticlimatic. She had been escorted to a central point by two females who found her in the tunnels, and for a while she was forced to wait amid comings and goings as uncoordinated as the confusion she had left behind. For too many with not enough to do, Emma was a diversion which made her an object of intense curiousity, and the area became even more crowded as word spread of her presence. Finally she was rescued by an armed male who took her a short distance to where Delbroj was examining the wall of a small branch tunnel. Emma's heart sank. She knew what was a few meters behind that wall.

Delbroj turned to her. "Jihevva said you wanted to talk to me."

Praying her consternation did not show, Emma nodded. "Yes, master."

"Why should I listen? It is you who turned so many away from the Path."

Emma had an inspiration. She said defiantly, "You can kill me if you

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choose. But would that make any difference?"

The old Silver chuckled. "Little one, you attach too much importance to yourself. If I had thought your death would make Jihevva and his friends rededicate themselves to the holy cause, you would have been made a corpse as soon as I knew you were here."

"In the same way, master, is it not possible *you* are attaching too much importance to one slightly infected planet? It is—"

"Enough!" For a moment Emma thought Delbroj was going to strike her. Instead, he beckoned. "Come."

She knew where he was taking her as soon as they entered the descending ramp toward the drive chamber in the base of the asteroid. She had been there before, as human-Phuili crews installed the latest in phase-shift equipment, and later when they removed it after the Ark had been safely diverted to this galactic backwater. She expressed appropriate awe as they entered the huge chamber, and listened politely as Delbroj pointed at the melted slag which covered most of the floor.

"It does not look like much now, does it little one? But it propelled the Ark half a light-year from our exploding sun in the same time it used to take to travel from Homeworld to the First Moon. Given a few more months, I think we would have solved the problems of surge and meltdown and created a *real* interstellar drive. Anyway, I brought you here to see this."

He pointed at a body-width hole in the lower wall of the chamber. At the back of the hole gleamed a metal fitting resembling a sophisticated cross between a bolt head and a hook. Emma knew there were six of them; the anchors for the cables which had suspended the substitute phase-shift core in the center of the space. A litter of broken rock near the hole was a clear indication of poorly packed concealment, and Emma's claws twitched in their sheaths as she thought of what she would like to do to the careless technician responsible for this disaster.

Delbroj said flatly, "It was not there when the Ark was launched on its journey. Neither is it anything we could have made; the metal is completely resistant to the hottest torch, and the few scrapings we have taken defy analysis. It is apparent therefore that *strangers*—" As he spoke the word, the master's fur bristled and his eyes glared. "—have somehow made our Ark turn to this unknown star and to the unholy temptation of what you, small one, choose to call a "slightly" infected planet!"

A large hand grabbed the base of Emma's neck and she was hustled back up the ramp, past throngs of curious Silvers, finally into the small side tunnel. Still with a firm hold on her, Delbroj continued, "If these *strangers* are observing us from space, it follows that we in turn should be able to see them—"

Not true. Emma knew the big Headquarters ship was only light seconds away, safely concealed inside its bubble of masking fields.

"—but because we cannot see or detect anything unusual in near space, what we seek must therefore be elsewhere. Perhaps even inside the Ark itself." Delbroj released Emma and tapped the wall of the tunnel. "Here! Hidden in the only part of this former asteroid

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our builders did not have time to excavate. Yet which I suspect *has* been excavated. Do you like my logic, small one?''

Despite the discovery in the drive chamber, evidence of concealed watchers was still pretty flimsy. Yet Delbroj had deduced the truth in a way which made Emma wonder if there were powers within themselves not even the Silvers were aware of. A subconscious sensitivity, perhaps, to the signals from her implant—

No! He is guessing!

''Now then. What is it you wanted to say to me?''

Emma despaired. It was obvious her mission had failed, and that the only course open to her now was to somehow join her friends and blast away from the Ark before Delbroj and his followers cut through to the command post. Helplessly she looked around her. In every direction her way was blocked either by solid rock or by watchful Silvers. *I can't get away from them*, she signaled. *Please save yourselves while there is still time!*

No, little sister. Silskin's reply was amazingly clear considering its passage through metal rich rock. *Be patient a little longer, and we will—*

There was the explosive crack of a projectile weapon, and with a cry of agony a Silver collapsed to the floor. Then an eye-dazzling flash, and a second Silver gasped and crumpled. Screams of rage preceeded an answering barrage of bullets, knives and even thrown rocks; adding an incredible cacophony of smoke and noise.

Again Delbroj grabbed Emma. ''Attack!'' he roared. ''In the Giver's name, attack and kill!'' He jerked his captive forward so violently, she lost her footing and was dragged painfully along with him. The pandemonium remained deafening as the master led his followers after the elusive attackers. Somehow Emma regained her feet and stumbled behind Delbroj with a limping run. It was obvious where they were heading, and she wondered why Jihevva and the others had forced the issue so soon. Silvers unsure of themselves, still adjusting to ideas which conflicted with every basic instinct, would melt away before this mad charge led by a charismatic prophet.

The projectile weapon sounded again, felling another victim who was instantly trampled under dozens of feet. There was a yell of triumph, and a cluster of bodies reeled toward Delbroj. A few breathless individuals separated from the scramble, revealing a young female struggling with maniacal strength against the grip of four large males. One of the four was flourishing the female's weapon, a wicked little fifteen-shot. ''Delbroj!'' Felwon yelled. ''Master, we spit on you!''

We? It did seem to confirm that Jihevva had acted with uncharacteristic rashness. Then again, it was also possible that Felwon had relapsed into insanity, taking to herself the impossible task of stopping the reactionaries and their leader. But who had used the beamer? As far as Emma knew, the most advanced hand weapon in the Silver armory was a sonic device which was great for crowd control, but hardly selective enough for individual targets. It was as if—

Silskin!

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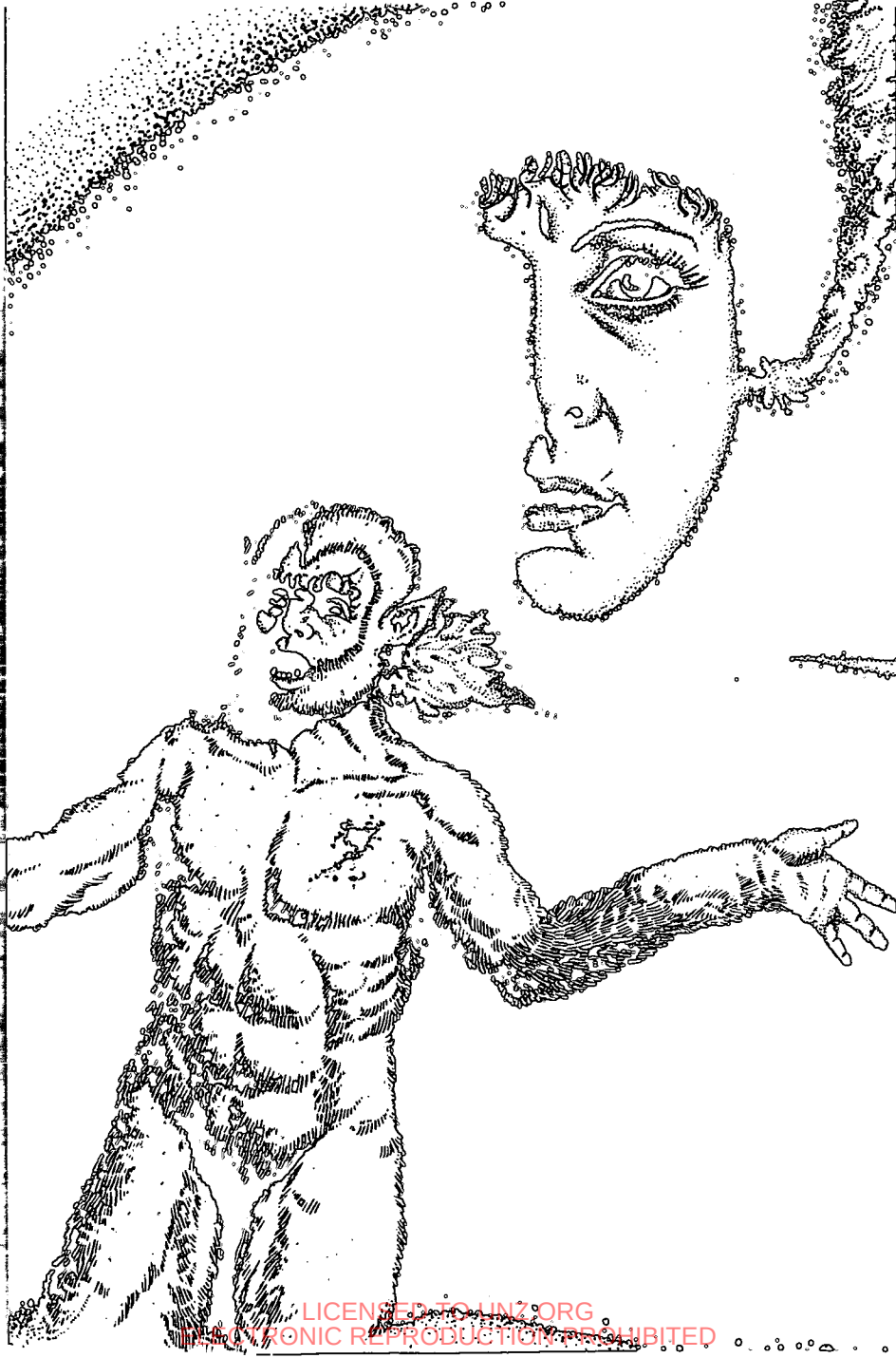

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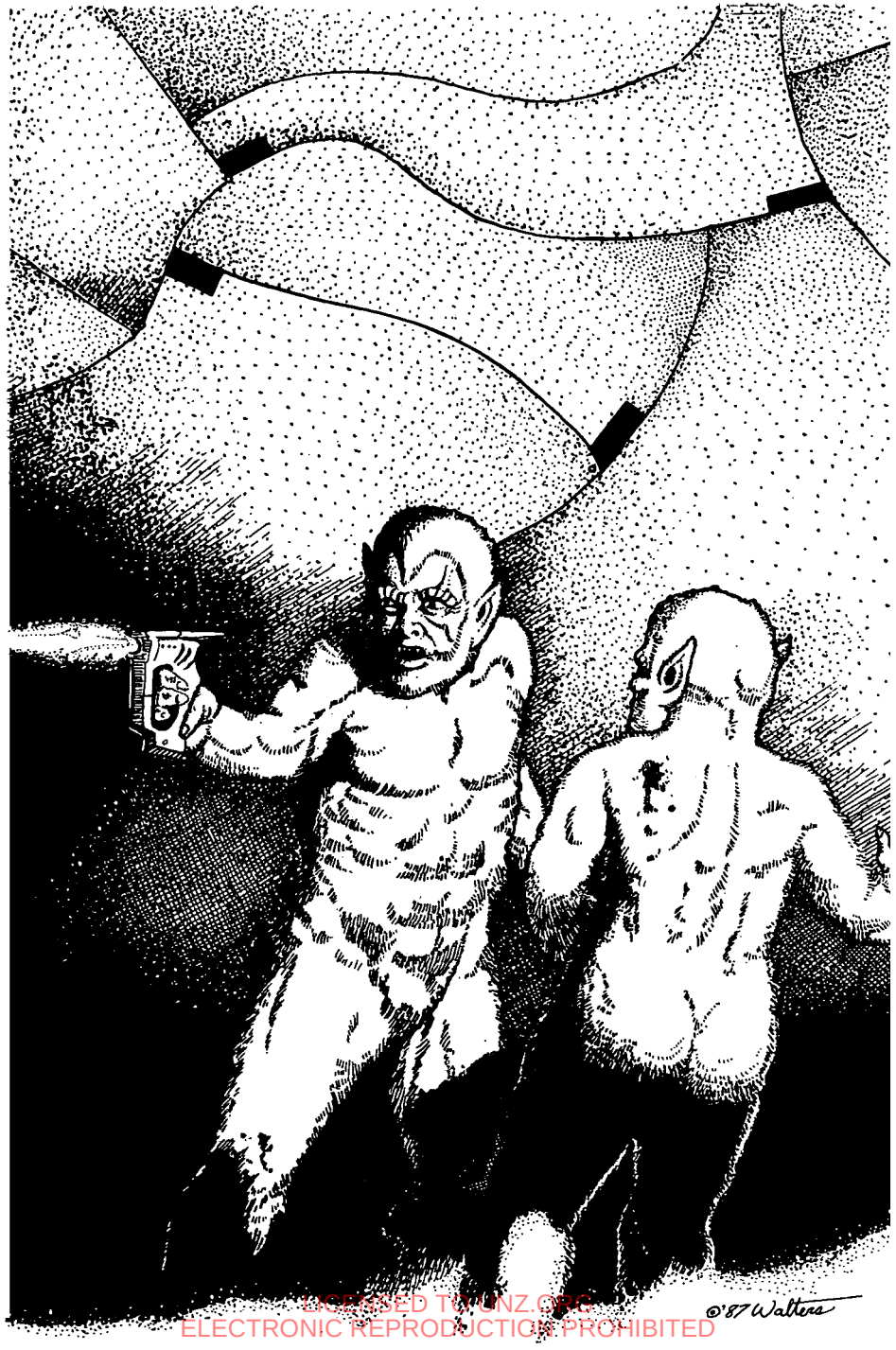

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That's right, sister. The help from that little female was unexpected, but who am I to complain? Anyway the rabble will soon be so confused they won't notice one extra Silver stealing away their captive.

But you have triggered them into attacking Jihevva and the others! It will ruin everything!

Emma, it is ruined anyway. Or haven't you noticed?

No! Emma desperately needed to talk to Momma Gia, but she knew there was not enough time. It had all played into Delbroj's hands; the discovery in the drive chamber, Felwon's crazed intercession, and now Silskin—

A large hand closed tighter around Emma's wrist. "Come little one. Learn with me how the Giver punishes those who dare usurp his holy authority." Pointing, Delbroj shouted, "Destroy the blasphemers!"

"Destroy!" the crowd roared, and surged behind their leader and his captive. The beamer flashed from a side tunnel, and with a choked cry another fell. But now the master had his followers in such a state of holy frenzy, Emma doubted even a massacre could stop them.

I am coming up behind you. If I can get close enough to shoot that old—

Wait! There is a better way. Emma's free hand flashed forward and lightly scratched Delbroj's upper arm. At the same time she screamed, "He's dead! The Master's dead!"

He was indeed. The instant poison was so fast Delbroj's brain was destroyed even before he began to fall, and as his grip slackened Emma pulled free and merged back into the crowd.

Those closest, who had heard Emma and then saw their leader fall, wailed with dismay and pummeled and pushed themselves into a protective wall around him. Just before the jostling screen of bodies blocked her view, Emma saw some of the followers kneel and try to prod the master back to life. The attack had already degenerated into a disorganized confusion, and as she quietly slipped free from the milling throng and turned away, Emma's feeling of horror at what she had done was only slightly mollified by the fact it seemed to have had the desired effect. But before she could be sure, she knew she had one more unpleasant duty.

She found Felwon leaning weakly against a tunnel wall. Another Silver was applying salve to a wound in the young female's side.

"Silskin!"

He grinned at her. "Hello Emma. Congratulations."

"For what?" She did not know why they were using the slow talk of normal speech, but its friendly familiarity was very satisfying.

"For getting rid of the old one. You saved the mission, you know."

"Perhaps," Emma said tiredly. She turned to the female. "How do you feel?"

Felwon's eyes glittered. "I will be well. What is that language you and this one are talking?" She pointed at Silskin's weapon belt. "And what is that which made the light? It killed!"

Emma felt numb. Not that she supposed Silskin's foolishness before Felwon really made much difference. The female's youth and charisma was a near guarantee of eventual leadership, and

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it was certain her half-crazed fanaticism would leave a legacy of *jihad* which would persist for generations.

It could not be allowed.

Emma asked in the local language, "Silskin, will you please leave us for a few moments?"

"Of course."

As her brother faded into the darkness of a side tunnel, Emma said quietly, "I think you are my friend, Felwon."

"I can no longer allow myself to be diverted by friendship, Berein. Now there is a light I must follow."

"I understand." Emma gently touched the wound. Something glistened under the claw of her thumb. "Let me finish dressing that."

"Why?" Gia Mayland persisted with a mixture of anguish and anger. "Emma, you have no reason to stay with them. Jihevva is a good leader, and I am sure his pragmatism will spread to those around him. In a couple of generations, their allergy to life will be no more than an ugly memory."

Poppa Kurber took up the argument. "In any case Emma, aren't you forgetting the other arks out there? What we did with this group was only a dry run, an experiment to prove that we no longer need to destroy the Silvers when we find them. And it is you who have given us that proof. So with your experience—"

"What do you know about the native life on that planet?" Emma interrupted.

Kurber shrugged. "Only that it is sparse. Which is another reason you should not go. Even if your friends can get over their aversion to natural protein, the possibility of starvation will always be there."

"Zere is what is in sea," David said.

"Oh thank you!" Emma ran over and hugged the old Phuili. "Poppa David, please tell them!"

Davakinapwottapellazanzis's muzzle twitched with the Phuili equivalent of a smile. "I zink Emma alweady done more study of planet zan us. Ocean have much life. Some much large cweatures in water which wesemble whale cweatures on human planet. Perhaps wiz intelligence like whales. Zerefore I say expewiment stay ongoing. Emma keep implant in head, she talk wiz us by welay we place on mountain top."

"I suppose we could maintain a small craft and crew in this system," Kurber said cautiously. "And when Emma can no longer—"

"You mean when I am too old?" Emma laughed happily. "By then I will have had young ones, and they will be trained to be yours dear Momma Gia, and dear Poppas Jase and David." She opened her arms and hugged them each in turn. "Now you have only six. But in time, don't you see, we can give you thousands!"

Gia Mayland held out her hand. She was wearing the glove of secret-talk. Emma, aware the nerve blocks would have to be restored before she rejoined her other family, accepted gratefully.

You are my child and I love you.

It was an astonishing truth, and Emma knew this moment would be with her for the rest of her days.

And I love you, Momma Gia.

The sun was already fatally close. Even as the rock on the sunward side

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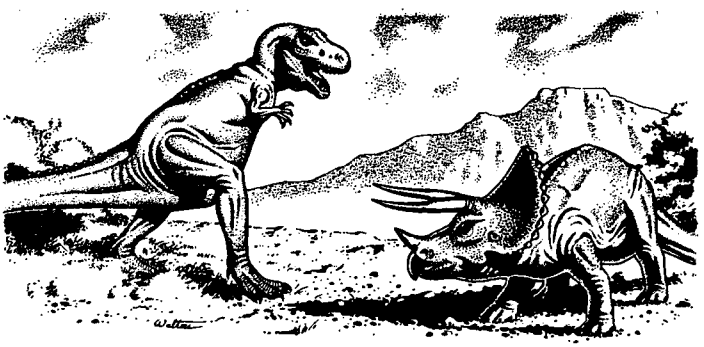
of the drifting asteroid began to melt, the last ships lifted from its surface into the dark.

On the planet, nearly three thousand of the tiny vessels were already clustered on a high dry tableland. Their crews were busy assembling temporary shelters, and a few disciplined souls had suppressed their revulsion enough to begin gathering small quantities of local life stuff for analysis.

A few hundred kilometers distant, "whales" began to gather near the shore of the continent. With cool, dispassionate intelligence they made contact with the creatures who were their flying proxies, and through the air-borne eyes they watched.

And waited . . . ■



ON GAMING

(continued from page 81)

two Ogres against an expanded defense force. The game is also highly enjoyable as a solitaire game. Simply program the movement of the Ogre (or use dice to randomize a zig-zag pattern) while you try and stop it.

Which is far from an easy task.

Even if the Ogre simply moves and fires at the nearest targets, it's still an incredibly difficult force to stop. Once you hit on a strategy for taking out the super tank, you can spice things up by playing with two Ogres and a more powerful defender.

So, simpleminded to be sure. But the game is decidedly challenging in the same way that chess is. The Ogre player must decide which targets to disable, which to eliminate completely, and where to ram with the central idea of using its weapons wisely.

The defender, on the other hand, has to play the Ogre as if it were Refrigerator Perry plowing through the 20 yard line. You have to second-guess its movements—always leaving a reserve to the rear—while making effective use of its limited firepower.

Origin Systems has released a faithful computer version of *Ogre*, but the physical fun of moving the pieces in this Deluxe Edition is a pleasure you shouldn't pass up. ■

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brass tacks

Dear Stan:

Thanks for giving me the opportunity to reply to some of the many letters *Analog*'s received concerning my latest article "The Curious Case of the Humanoid Face . . . on Mars"; November, 1986). The responses revealed a range of fascinating reactions—the most striking to me, the inclination of many readers to *ignore*—completely —everything mentioned in the article—

With the exception of the Face.

The tendency for this one "artifact" (of the many that I cited at Cydonia) to continue to monopolize attention, lends intriguing support (if indirectly) to at least one reader's "model" for its presence: that it was intended somehow as a "message" *in our image*, to capture our attention . . . which it finally seems to have accomplished! The primary purpose of the Face, then, in this reader's theory, was to compel us to further exploration of the Martian surface. If so, then amen!

In the brief space allotted here, I cannot possibly do justice to this or any of the other complex issues readers raised. But at least I can hit the high points. [For more in-depth treatment, including of the "message model," I refer readers to the newly-published *The Monuments of Mars: A City on the Edge of Forever*, by Richard C. Hoagland, North Atlantic Books (2320 Blake St., Berkeley, CA 94704), 1987.]

Some readers reiterated much of what has passed as the planetary community's "discussion" of this issue for the past ten years, including the observation that "seeing faces is one of the commonest visual illusions . . . " This is right on—

If totally irrelevant to *this* discussion.

After four *years* of exhaustive *measurements*, the discovery of additional provocative objects in the immediate

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vicinity, and the demonstrably *specific* geometric groupings and relationships of these to the "Face" cited in the article, to continue to discuss the entire complex epistemological phenomenon as "mere psychological projection" does great disservice not only to the scientists involved, but to the real and decidedly non-trivial mystery represented by the discovery of a *measurable* "humanoid face" (and its associated "megamorphs") lying on a near by planet.

Many readers sought to explain such continuing denials, by NASA and others, by attributing them to ordinary human "inertia" (personal *Weltanschauung*, or *world views*—which in terms of current evolutionary theory simply cannot "allow" humanoids on any other planet), or to the structural limitations of the scientific community when "investigating an unorthodox phenomenon. . . ."

My reaction: when you've seduced (a deliberate choice of words . . .) *a billion dollars* out of American taxpayers for the expressed purpose of "looking for life on Mars," then have consistently ignored inexplicable evidence (albeit, in an unexpected *form*) suggesting to some scientists that you may, in fact, have found it—while simultaneously ridiculing those same serious scientists, at major research institutions (SRI, Sandia Laboratories, University of California, etc.) who've actually *examined* said evidence, something's not only suspiciously wrong with the "Popperian ideal" of scientific inquiry—

Something definitely smells.

Of the few readers who actually attempted to address my specific epistemological approach to this whole matter ("systems theory" and mathematical studies of the probabilities of the geometries and alignments involved), one response was if nothing else . . . entertaining.

After noting "given a random pattern of features one can produce any number of interrelationships, post hoc," the author went on to cite *not* the features at Cydonia that he inferred (no measurements, of course) were arrayed "at random," but "a New Zealand UFO nut who developed 'harmonic circles' connecting major psychic locations on Earth." This tendency to broadside a *particular* phenomenon by sweeping *generalizations* (such as, "in my pseudoscience excursions [I've] seen similar claims before") are not only irrelevant debating techniques, not scientific analyses, they are all too common in these discussions—this time, suspiciously, from a well known employee of the very space agency whose motives I now seriously question, for "losing" this data for so long.

To me, the most fascinating reaction to the article came, not from continued NASA denials, but from a *Soviet* scientist. Referring to a copy of *Analog* apparently "smuggled" into the Soviet Union, he wrote:

"I have been studying the problem of extraterrestrial intelligence during the last 20 years. In 1980 [I] defended my dissertation 'Philosophico-Methodological Aspects of the Problem of Extraterrestrial Civilizations' . . .

"I am especially interested in the article . . . The research work of the author is, in my opinion, a very promising one, worthy of every attention and support . . . the findings are thought-provoking and highly convincing . . . There has been published in a Soviet annual [another] interesting article on the 'Martian face.' I will try to send it to you . . . "

What makes this particular letter of more than passing significance, is the

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fact that the true test of the "Intelligence Hypothesis" lies not in endless continuing discussions—

But on the Martian surface (a point well-recognized by a majority of readers)!

The relevance of a Soviet reaction to "anomalous features" at Cydonia is simply this: at this writing, the first opportunity to verify any of this evidence will be during the approved and funded Soviet "Phobos Mission" (1988/'89). "Phobos" will conduct synoptic, high-resolution photography of Mars after its historic rendezvous with the inner Martian moon; attention now by Soviet scientists to "the problem of the Face" is encouraging—an essential prelude to the high-level cooperation necessary if Soviet mission planners are to factor in new pictures of Cydonia, and (in accordance with a newly signed Space Cooperative Agreement betwen the U.S. and the USSR) for them to *share* those pictures with the rest of us.

Finally, one particular American response to the Cydonia article struck me as downright bizarre—strangely parallel, in fact, to some of NASA's actions on this issue . . . The idea: that NASA mount some kind of "low-profile, clandestine mission" to circumvent adverse media reaction and public ridicule—if the whole thing should turn out to be a pile of rocks!

For a variety of reasons—ranging from our unique historical heritage, to the tragic consequences that have inevitably followed attempts to conduct "secret" policies in contradiction of that heritage (the Iran/Contra hearings form the live television backdrop for these thoughts)—I found this proposal as incredible, as preposterous and politically appalling (and from "a historian," no less!) . . . as the growing suspicion that ten years ago another NASA Mission *found* something inexplicable upon the Martian surface . . . and from similar cowardice and lack of confidence in the American people, NASA conveniently "lost it" in a drawer . . .

In all likelihood, it will be a "closed" society (the Soviet Union) which verifies this data, while our supposedly "open" institutions continue to ignore it. The irony will not escape future generations. The proponent of the "clandestine mission" idea did enunciate one truth: "Until . . . useful debate is engendered in the public forum, pathetic suggestions similar to mine are likely to remain the only 'safe and sane' method of investigation."

If the latter part of his statement is true, then we are truly witnessing the decline and fall of Western civilization . . . and the East will take the prize.

If, on the other hand, public interest and debate on this issue continues to increase (as is occurring in the pages of this magazine), groundwork will be laid for the ultimate *public* confirmation or elimination of this data . . . as the first real evidence of an extraterrestrial civilization . . . in an *open* mission to the Martian surface.

Yes, John Campbell would heartily approve.

RICHARD C. HOAGLAND

Dear Mr. Schmidt:

I was delighted to see two stories in the latest issue of *Analog* dealing with the formation of the United States of America. "The Forest of Time" by Michael Flynn, is accurate in its politics. Had a few of the key leaders been killed, the Union might not have been formed under the constitution. Exactly as he postulates, different European nations would have worked their intrigues

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in the New World. Our continent would have been the scene of interminable wars.

The more likely failure, however, would have been in Philadelphia. There were several occasions in the constitutional convention when the absence of a single state from the meeting meant the difference between success and failure. On one occasion the fate of the Union rested not on an entire delegation, but on the vote of a single member from Massachusetts.

Likewise, ratification was a close call. The margin of victory in Virginia was only ten votes, with the great Patrick Henry leading the opposition. Had Virginia stayed out of the new Union, it would have renewed its western land claims. The residents of St. Louis and San Francisco would today be Virginians. In New York, the margin was even closer—three votes. New York would have owned Chicago and Seattle.

The second story, "Safe to the Liberties of the People," by W.T. Quick, was most interesting, but contained two critical errors. The first is the statement that it takes thirty-eight states to call a constitutional convention. That is the number to ratify. It takes only thirty-four to call a convention.

The larger error is the assumption that limited state calls for a constitutional convention on different subjects can be added together to produce the necessary thirty-four. The fact is, forty-four different states have passed calls for a convention as of now. Thirty-two are restricted to the balanced budget amendment. The others all have specific subjects, from prayer in the schools to abortion. If different subject-matter calls could legitimately be added, the second convention would have occurred ten years ago.

This leads to the incorrect assumption that any convention must be an unlimited one, that "the whole constitution is up for grabs." I've studied and/or taught constitutional law for twenty years, had twelve cases to date in the Supreme Court, published one of the major papers, and testified to eight state legislatures and two congressional committees on this subject. I don't like to see my fellow readers of *Analog* misled, even by inadvertence. The answer to this question is a solid no. If the states want a limited convention and thirty-four can agree on a single subject, then that is what they get.

The American Bar Association officially took this position in 1973. All five convention procedures bills introduced in Congress also agree. So do most experts.

The strongest argument against the open convention is the Civil War. Between 1787 and 1789, eleven states decided to leave the Union under the Articles of Confederation and join the new Union under the constitution. When the north won the Civil War, the issue was then settled that no state can simply walk away from the existing government. The Confederate States of America had sound theoretical grounds to secede in the writings of the Framers. But, war is the ultimate way to lose a debate.

In short, what happened 200 years ago cannot be repeated unless thirty-four states specifically request an open convention. No state has done that since 1791.

The thesis of the article is that the constitution as a framework for government should continue to stand firm. I heartily agree. However, that end is not advanced by an approach to Article V in which the first great political right of the people, "to alter and abolish their

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Forms of government," is gutshot by misanalysis.

The right of the states to force an amendment, when Congress stands in the way, is one of the checks and balances deliberately put in the system for our use. And it was used for the seventeenth Amendment. The senators liked the cozy arrangement of not having to face the voters. Five times between 1893 and 1910 they rejected a House-passed amendment to make the Senate elective.

Once thirty-one of the then required thirty-two states had called for a constitutional convention on that point, the Senate relented. It passed the 17th Amendment, but included a grandfather clause protecting all senators then serving from the effects of the amendment. If you pull out a copy of the constitution, and read the last clause of the seventeenth Amendment, you will see the proof of this. I call it the Swamp Water Theory—Congress will swallow anything if you give it only two choices and the other one is worse.

The present state calls are conditional (allowing Congress to act first), and they contain various types of self-destruct or "null and void" clauses to prevent an open convention, rather than a specific subject convention, check the Congressional Record, 20 June 1984, pp. H-6196 to 6215.

The constitution should last another 200 years, and eventually provide the framework of government for humans living in space. If so, the amendment provisions of Article V will remain important then, as they were at the beginning, when the first use of them was to adopt the Bill of Rights.

I thoroughly agree with those science fiction writers who see the structure of governments as one of the key elements of their stories. In general, stories such as the two you have just published are a good contribution to the bicentennial of the constitution. They encourage your readers to consider the continuing importance of that ancient but modern document.

JOHN CHARLES ARMOR
Washington, D.C.

Dear Stan,

The essence of your argument in "Child Abuse," June '87, is that children's opinions should be grown by discussion, rational examination, and objective factual confirmation.

This is unrealistic. Too many people are incapable of rationality. At least 40% of the population may be unable to cope with hypothetical reasoning. You may dispute the 40% figure. Try your own experiment. Get $20, go on the street, and offer $2 to each of the first ten people you meet. Tell them you are taking a survey. Ask them what they would do if they survived a nuclear war. My percentage was much greater than 40%. Despite the fact that their survival was a "given" the only thing they could think to say was something like: "I don't know, whatever I had to!" or "That couldn't happen; we'd all be dead." What I was looking for was the tiniest germ of a rational plan. One man said "find the authorities and try to help."

These "40%" cannot change their moral philosophies or ideologies because they literally cannot imagine that anything other than their early training is correct. Most of these people's opinions are "absorbed" before puberty, when they are still incapable of formal logic. If they are taught situational ethics, they will be immoral. If they are taught rigid standards of ethics they will at least be ethical (and probably insuf-

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ferably self-righteous, which is easier to cope with than immorality).

Teaching a really rigid, loving, morality will not harm the students who can reason. Eventually they will come to see it as a starting point for their personal morality, and in the mean time, they will not make major mistakes with their lives.

It is a modern fallacy that variety is good. Remember Sturgeon's Law: 90% of everything is junk. So .9*.4= 36% of people will turn out bad if everyone is taught all sorts of competing moral ideas. In practice, many of the most admired people of modern times practiced very, very traditional ideals, morals and ethics. If traditional ethics are good (and clearly they are, or they would have been discarded generations ago), then it is both sensible and desirable to protect young people from non-traditional ethics and moralities until they have stopped absorbing and started criticizing.

That 40% is a real powder keg of potential trouble. The plan should be to make their rigidity work for stability, not against it.

RAY VAN De WALKER

Santa Ana, CA

Fascinating! On the basis of your "experiment," you state with a straight face that 40% of all people are "incapable of rationality"? I can't help suspecting that around the time printing was invented you would have been one of those proclaiming that most people couldn't handle reading.

The whole point of education is that people can learn *to do things that they can't already do. My experience as a teacher suggests strongly that most of them can learn a lot more than they think they can—and* surely *more than* you *think they can!*

* * *

Dear Mr. Schmidt,

Much to write about in your June issue, some very good, some not so.

First, congratulations on your editorial on the Tennesse school case, one that probably should be read by the head of every board of education in this country. This is a set of ideas that many of us who are interested in higher education for all hold, even if we don't admit them as much as we should. The suppression of ideas by well-meaning parents, hoping to keep their children "morally" pure, is one of the most insidious threats we face to the future of our country. Freedom of thought is probably even more important to the future of this or any other country than any of the other rights, for without it there is no freedom of speech, press, or any of the other rights we hold so dear.

Now for the bad news. While I fully agree with your statement that Ben Bova's "Moonbase Orientation Manual" represents something that could be possible if we all work towards it, I hope someone fixes the hole that was in the plan or it's not going very far.

One of the biggest of these is the idea that concrete would be suitable for air-tight bulkheads. Nice idea, but while concrete is strong enough, it is most definitely *not* air-tight. As proof, I submit the people who, without a crack or check to be found, suffer from wet basements here on Earth. So if it will let something as big as a water molecule past, I hope that those colonists are smart enough to line any of their concrete bulkheads with plastic or airtight foam. The oxygen bill is going to be fairly steep if they don't.

Secondly, why the heck go to all the expense of making an optically perfect mold for the manufacture of large mirrors for telescopes? Are you planning to build several thousand 1000 cm. mir-

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rors? There is, at present, a better technology for the manufacture of mirrors in place here on Earth. Called soin casting, it requires nothing more involved than a circular mold and a spinning table. University of Arizona researchers have already produced several large mirror blanks with this method, and are working on upgrading their equipment to handle large (two-three meter) mirrors in the future. While the blank produced in this manner must still be brought to optical finish with grinding, the task is a small undertaking compared to the work involved in doing the same process from a flat blank. With this process, the proposed Lunar mirror makers could make custom mirrors, limited only by the size of their form and spin table, without the need to make a custom mold to optical tolerance every time.

Finally, I can understand the use of ceramics for plumbing, conduits, and even furniture, but what the heck do you need ceramic bricks for? You couldn't build a shelter out of them, as they would be harder to handle and make structurally sound than cast concrete. They wouldn't be useful for internal dividers in housing, as it would be easier to pour divider walls at the same time that the rest of the structure was being built. Walkways? A fairly vain use. Others? Maybe something to throw at the guy who thought of using time and materials on something this useless.

I sincerely hope that we, all the spacefarers, go back to the Moon as soon as it is possible. Let's look at what we want to do when we get there *now*, so we're not doing things that don't really need doing (bricks indeed!).

ANDREW REYNOLDS

Roselle, IL

The author replies . . .

As pointed out in Welcome to Moonbase, *lunar engineers are smart enough to line concrete structures with Moonbase-manufactured plastic sheeting, where the structure must be airtight. And I'm sure they use the best possible techniques for making mirror blanks; after all, high-quality and precision optics is a major Moonbase export item. As for ceramic bricks, they are much more versatile and useful than permanent ceramic structures in situations where their configuration is apt to be changed from time to time.*

BEN BOVA ■

INDEX CORRECTION

For those of you who are interested in *Analog*'s 1987 index, which appeared in the January 1988 issue, there are three corrections: Ray Brown's "Cobwebs," Joseph Manzione's "Candle in a Cosmic Wind," and W.R. Thompson's "Lightning Rod," all appeared in the August issue, *not* the July issue.

We sincerely apologize to our authors and readers for any inconvenience this may have caused.

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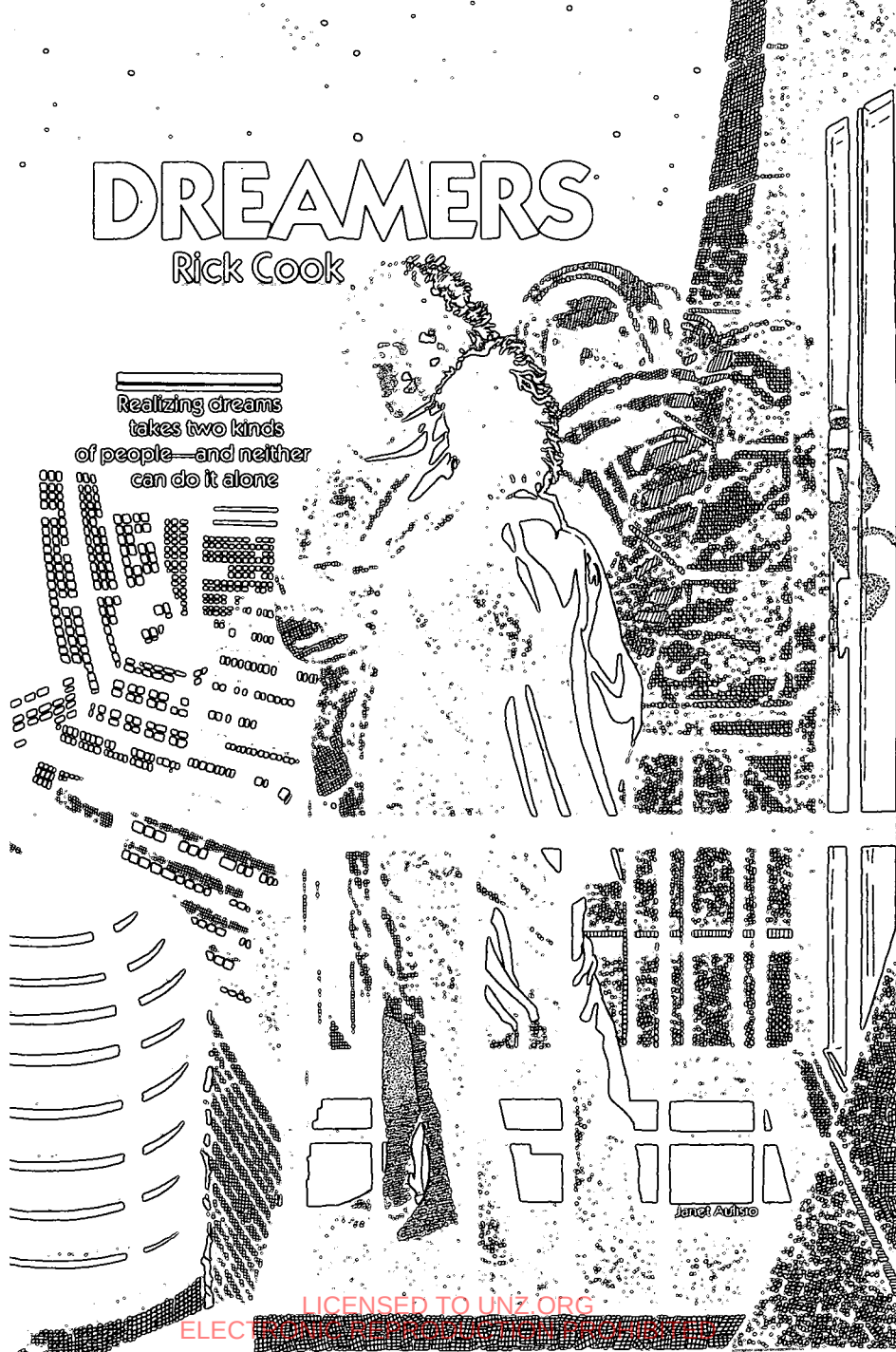
DREAMERS

Rick Cook

Realizing dreams takes two kinds of people—and neither can do it alone



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Allll of the fiilllkers are siiiiingiiiinnggg . . .

At least *that* one was supposed to be sung off key, Jan Raymond thought as the noise rattled the sliding glass door. But the guitarist should still hit the right chords and the kid in the hotel room kept missing the barred ones.

She stood on the postage-stamp size balcony and looked out at the lights of the city. Whenever the singers inside stopped for breath the cold night air brought faint traffic sounds up from the street.

After "Hope Eyrie" and "Harbors" and "The Challenger Lament" the group had gotten off into Star Trek and Dr. Who songs and then into silly parodies. Jan had lost interest and wandered out onto the balcony to get away from the smoke-laden, overheated air of the room—and some of the singers who weren't too careful about bathing regularly.

I wish I still smoked, she thought moodily as she thrust her hands deeper into the pockets of her suit jacket to ward off the autumn chill. *It would give me something to do with my hands.* For a moment she toyed with the idea of going down to the hotel shop and picking up a pack. But that would only make things worse in the long run, she knew. One more sign this weekend wasn't working out at all as she had hoped.

Part of it was the fight with Peter. He had never enjoyed science fiction conventions and he couldn't understand why she wanted to give up a wine country weekend to attend one.

"Because *I* like them, that's why," she snapped.

"Oh come on, Jan," he said in that maddeningly reasonable tone. "You told me you can't stand most of the people and you never go to the panels. How can you like them?"

She didn't have a good answer so she stormed out of the house and arrived at the airport two hours early. Never argue with a lawyer, especially not when you're married to him.

Softly, and without quite understanding why, Jan Raymond began to cry.

So here I am, she thought, blinking back tears, *spending the weekend hanging around a second-rate hotel—in* Minneapolis, *for God's sake, in* November, *for God's sake—with a bunch of people I don't really like. And for what?*

She knew for what, of course. She had always known, ever since she was a little girl raiding her father's science fiction collection for something to read. She wanted to GO. She wanted to go into space so badly she could taste it and she had for as long as she could remember. At least the people she met at these conventions understood that. They shared that same hunger, many of them, and they didn't look at you like you were a little strange when you let on. They might be geeky social misfits, but they had the dream.

In Cupertino, she thought wryly, it was more socially acceptable to admit you were into light S&M than it was to say you cared about space.

She'd come hoping for—what? —release? Communion? A feeling that somehow her dreams still mattered. She hadn't found it and she felt cheated.

Ten years ago these cons had all been space. The people on the panels had talked about how to build a space station, and how to live in space. How we

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were going to mine rocks on the Moon and use the material to build huge floating cities, how giant solar arrays in space would solve the world's energy crisis and lead us into a new era of peace and plenty.

Now? Well the space shuttle patches still sold briskly in the hucksters room, and there were still space T-shirts to be seen, but beyond that? The only space panel at this con had been on the Star Wars missile defense and it had dissolved into a shouting match after fifteen minutes. A strong faction had claimed it was immoral to go into space on the shoulders of a military effort.

Immoral!, Jan thought, scandalized. *Immoral to go into space!* She wasn't sure she favored a missile defense, but the idea that getting into space could be immoral made her sick to her stomach.

It isn't that those people don't care, she thought. They do. But effective action was simply beyond them. She'd tried. Oh, how she'd tried. You could stir them to spasms of letter writing, but that was all.

The door slid open and a young man stepped out on the balcony.

"Lovely night isn't it?"

She had been peripherally aware of him all through the convention. He was small and slender, with chocolate skin and a shock of straight black hair. An aquiline nose and just a hint of an epicanthic fold at the corner of his brown eyes. He was holding a cup containing the dregs of blue liquid. Romulan Ale or Water of Life or whatever they were calling it at this party. Some god-awful concoction colored with Blue Curacau, heavily spiked with vodka and with enough fruit juice and soda added to kill most of the taste of the alcohol. Anyone over the age of twenty drank it at dire peril to their metabolism. Jan remembered seeing him hanging out by the punch bowl, listening as a couple of fans argued at the top of their lungs.

Squinting in the dim light she could barely read his name tag. It was one of those custom ones by a local artist. The first name was in large print and the last name was in smaller, more ornate script. Paul somethingorother.

"Forgive me, but . . . is something wrong?"

Normally Jan would have done the civilized thing and disclaimed any problem. But she was sick of it all so she rounded on him as a stand-in for the rest of them.

"Nothing except I'm surrounded by idiots," she said bitterly.

Paul raised his eyebrows. "Oh? You mean the people at this convention? They seem fairly intelligent to me."

"Idiots," Jan repeated firmly.

She let out a long breath. "Look, I'm a space activist. For the past ten years I and others like me have been trying to weld this bunch into an effective lobby to get us into space. You want to know how successful that's been? Look at our so-called space program! And these afficionados of the 'literature of the future' won't do a damn thing to make that future happen.

"They seem very interested in space," Paul said.

"Oh they're interested. But they won't *do* anything except talk about it." She made a face. "God how they will talk. They'll talk and talk and . . . " she broke off.

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"They are very vocal," Paul observed mildly.

"Vocal and totally ineffective," Jan said bitterly. "You know how many science fiction fans it takes to screw in a lightbulb? Three thousand, four hundred and ninety-five!

"Here," she said, fumbling in her purse, "I've worked it all out." She pulled out a list and began reading. "You need ten fans to run the pre-bid committee to get ready to bid for the job of changing the lightbulb, twenty to run the actual bid to change it, fifty to act as convention committee for the lightbulb changing, thirty-five to replace the committee members who have split off because of fannish politics, five to negotiate the contract with the hotel so you will have someplace to change the lightbulb." She took a deep breath and kept reading. "Seventy-five to be senior staff at the lightbulb changing, one hundred staff members under them, two hundred to act as volunteers at the lightbulb changing and three thousand to attend the lightbulb changing."

Jan looked up at Paul. "And after all that, the lightbulb never gets changed because that's dealing with reality and fans don't deal with reality worth a good goddamn!" She started to cry again.

"You're being a little hard on them," Paul said gently.

"Am I? There's more brain power in that room than you'll find in any three Congressional committees. Yet most of them have trouble holding down a steady job and all of them together can't make something happen no matter how badly they want it."

Paul shook his head. "That's not their function. They have a more important job to do."

"What, to sing stupid parodies?"

"No, to dream."

"Huh?"

"Someone has to imagine the possibilities and show them to others. It's the most fragile, difficult talent we human beings have and those people in there have it in full, rich measure. In their own way they are doing more to get humanity out into space than your three Congressional committees ever will."

"You sound awfully sure of all that."

Paul hesitated. "I know it," he said simply.

"How?"

A much longer pause. "Because I saw it happen. I'm from the future. I was born on one of those orbital colonies."

That brought her up short. You heard more bullshit at one of these conventions than you heard in a year on the outside. Teenage kids claiming to be intergalactic mercenaries. Older ones claiming to be even stranger things and some of them half-believing it. Men of all ages who would say anything to get into bed with any passibly good looking woman.

He's drunk, Jan realized. *That stuff must have really hit him hard.*

"I'm drunk," Paul said. "In our culture we don't drink much and this," he held up the cup, "is unusually potent."

"So what are you doing here? Using the convention to disguise your alien behavior?"

Paul smiled. "That is one of the advantages, yes. But mostly I'm here to experience the convention. To soak it

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all in. I'm . . . I'm what you'd call an intellectual historian." He smiled owlishly. "Except that's not right, either. Well, call me an intellectual historian."

Drunk or sober, he was oddly convincing, Jan thought. He wasn't bragging and he wasn't begging to be believed. Just a matter-of-fact manner and simple statements.

"All right, prove it. Prove you're from the future!"

. Paul smiled. "What shall I do? Whip out my trans-temporal communicator? We would be very foolish to carry anything which might mark us as not what we are supposed to be."

"But what if you get in trouble?" she countered, falling into the spirit of the game.

"Then we either get ourselves out of trouble or we die," Paul said simply.

"What if I told someone?"

"Who'd believe you? And if they did, do you think they'd believe I was not lying to you?" He grinned and looked more like an owl than ever. "As for an investigation, well my background is probably more solid than yours."

Jan didn't say anything. Unbidden a quote from some long-ago politician floated up in her memory. *Others look at the world and ask 'why', but I look at the future and ask 'why not?'* She shook her head.

"All right, imagining the something is important. But those people," Jan jerked her head back toward the room, "*didn't* imagine it. All they do is read science fiction and pick up the ideas from the writers. There's no creativity there."

"But who buys what those writers write?" Paul asked. "Who supports the books and magazines that spread the ideas? Who sees to it that those ideas become the common property of all the world?

"The essence of dreaming lies in nurturing a vision, in passing it on to others. Each one of those ones is a virus for their dreams. They infect those around them with their vision at least peripherally and subconsciously. They spread the notions throughout your culture and well beyond. They are gardeners preparing the soil and nurturing the seeds."

Jan had a mental image of a virus weeding a flowerbed.

"Jan, doing something is often difficult, but imagining it, realizing that it is possible, and communicating that to other people is always a hundred times more difficult. It takes a special talent to dream, to see beyond the here-and-now.

"And the dreamers are almost never the doers. The ones who can dream, who will give their enthusiasm to something that their fellows cannot conceive of, are—disassociated. Their attention is so firmly focused on their dream worlds that they tend to stub their toes in this one.

"But directly or indirectly they inspire the doers, the engineers, the entrepreneurs, the policymakers and all the others who will cajole and argue and maneuver and finally design and build."

Paul waved his cup in the direction of the hotel room. "Those dreamers are the first stage, Jan. They cast their vision abroad unheeding, almost as a side effect of their dreams. But somewhere out there are others who will catch the

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dream and be moved to make the vision a reality.

Inside the filkers had drifted back to space songs.

Mad is the crew bound for Alpha Centaurus; Dreamers and poets and clowns . . . She wanted to go back and join them.

Jan dug a tissue out of her purse and dabbed at her eyes. "You know," she told him, "I'm going to believe you. Not because this is believable, but because I feel better if I believe it.

"Goddamn it, I *want* it to be true! I want to believe that that American flag on the Moon won't be the last. That in spite of everything the United States is going to go ahead and explore space."

Paul started and then shook his head sadly.

"I did not say the doers will be Americans," he said gently. ■

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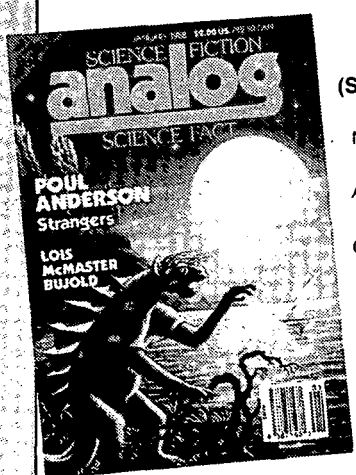

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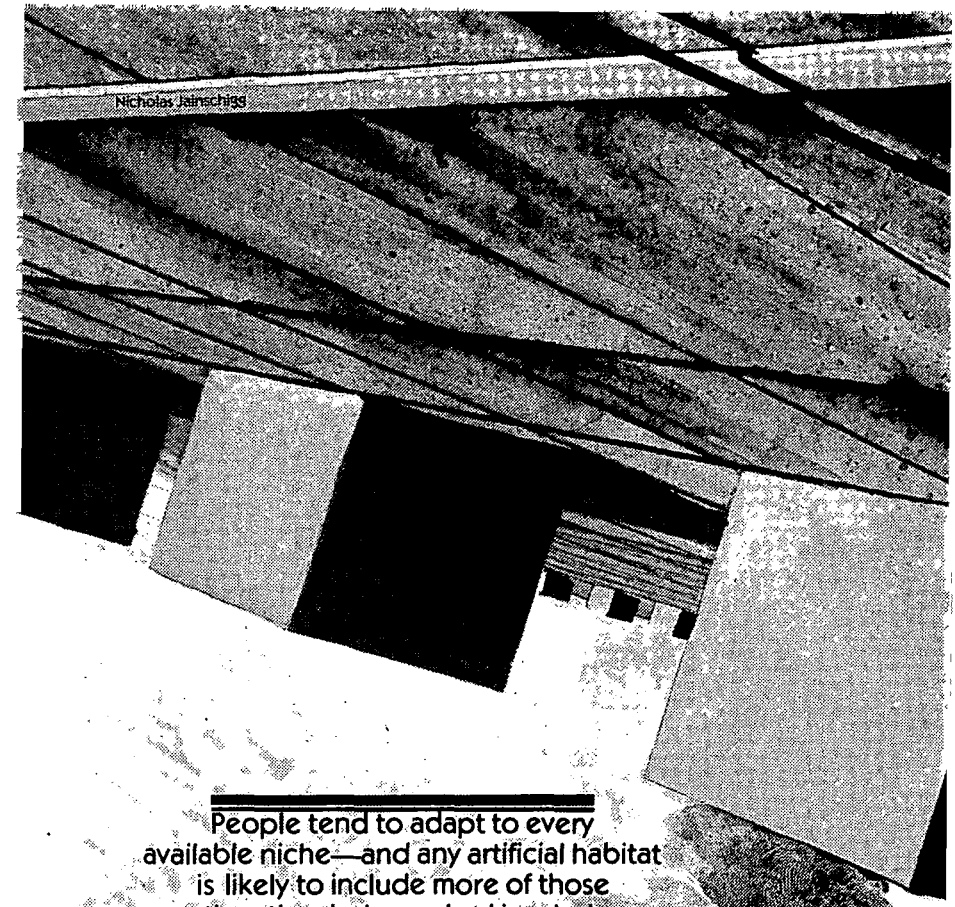

People tend to adapt to every available niche—and any artificial habitat is likely to include more of those than the designers had in mind.

PEACHES FOR MAD MOLLY

Steven Gould

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Sometime during the night the wind pulled a one-pointer off the west face of the building up around the 630th floor. I heard him screaming as he went by, very loud, like this was his last chance to voice an opinion, but it was all so sudden that he didn't know what it was. Then he hit a microwave relay off 542 . . . hard, and the chance was gone. Chunks of him landed in Buffalo Bayou forty-five seconds later.

The alligators probably liked that.

I don't know if his purchase failed or his rope broke or if the sucker just couldn't tie a decent knot. He pissed me off though, because I couldn't get back to sleep until I'd checked all four of my belay points, the ropes, and the knots. Now if he'd fallen without expressing himself, maybe?

No, I would have heard the noise as he splattered through the rods of the antennae.

Stupid one-pointer.

The next morning I woke up a lot earlier than usual because someone was plucking one of my ropes, *adagio*, thrum, thrum, like the second movement of Ludwig's seventh. It was Mad Molly.

"You awake, Bruce?" she asked.

I groaned. "I am now." My name is not Bruce. Molly, for some reason, calls everyone Bruce. "*Shto etta*, Molly?"

She was crouched on a roughing point, one of the meter cubes sticking out of the tower face to induce the micro-turbulence boundary layer. She was dressed in a brightly flowered scarlet kimono, livid green bermuda shorts, a sweatshirt, and tabi socks. Her belay line, bright orange against the gray building, stretched from around the corner to Molly's person where it vanished beneath her kimono, like a snake hiding its head.

"I got a batch to go to the Bruce, Bruce."

I turned and looked down. There was a damp wind in my face. Some low clouds had come in overnight, hiding the ground, but the tower's shadow stretched a long ways across the fluffy stuff below. "Jeeze, Molly. You know the Bruce won't be on shift for another hour." Damn, she had me doing it! "Oh, hell. I'll be over after I get dressed."

She blinked twice. Her eyes were black chips of stone in a face so seamed and browned by the sun that it was hard to tell her age. "Okay, Bruce," she said, then stood abruptly and flung herself off the cube. She dropped maybe five meters before her rope tightened her fall into an arc that swung her down and around the corner.

I let out my breath. She's not called Mad Molly for nothing.

I dressed, drank the water out of my catch basin, urinated on the clouds (seems only fair) and rolled up my bag.

Between the direct sunlight and the stuff bouncing off the clouds below the south face was blinding. I put my shades on at the corner.

Molly's nest, like a mud dauber's, hung from an industrial exhaust vent off the 611th floor. It was woven, sewed, tucked, patched, welded, snapped, zipped, and tied into creation. It looked like a wasp's nest on a piece of chrome. It did not blend in.

Her pigeon coop, about two floors lower down, blended in even less. It

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was made of paper, sheet plastic, wire, and it was speckled with pigeon droppings. It was where it was because only a fool lives directly under *under* defecating birds, and Molly, while mad, was not stupid.

Molly was crouched in the doorway of her nest balanced on her feet like one of her pigeons. She was staring out at nothing and muttering angrily to herself.

"What's wrong, Molly? Didn't you sleep okay?"

She glared at me. "That damn Bruce got another three of my birds yesterday."

I hooked my bag onto a beaner and hung it under her house. "What Bruce, Molly? That red tailed hawk?"

"Yeah, that Bruce. Then the other Bruce pops off last night and wakes me up so I can't get back to sleep because I'm listening for that damn hawk." She backed into her nest to let me in.

"Hawks don't hunt at night, Molly."

She flapped her arms. "So? Like maybe the vicious, son-of-a-bitchin' Bruce gets into the coop? He could kill half my birds in one night!" She started coiling one of her ropes, pulling the line with short, angry jerks. "I don't know if it's worth it anymore, Bruce. It's hot in the summer. It's freezing in the winter. The Bab's are always hassling me instead of the Howlers, the Howlers keep hassling me for free birds or they'll cut me loose one night. I can't cook on cloudy days unless I want to pay an arm and a leg for fuel. I can't get fresh fruit or vegetables. That crazy social worker whose afraid of heights comes by and asks if he can help me. I say 'Yeah, get me some fresh fruit.' He brings me applications for readmittance! God, I'd kill for a fresh peach! I'd be better off back in the home!"

I shrugged. "Maybe you would, Molly. After all, you're getting on in years."

"Fat lot you know, Bruce! You crazy or something? Trade this view for six walls? Breathe that stale stuff they got in there? Give up my birds? Give up my freedom? Shit, Bruce, who the hell's side are you on anyway?"

I laughed. "Yours, Molly."

She started wrapping the pigeons and swearing under her breath.

I looked at Molly's clippings, bits of faded newsprint stuck to the wall of the tower itself. By the light coming through some of the plastic sheeting in the roof, I saw a picture of Molly on Mt. McKinley dated twenty years before. An article about her second attempt on Everest. Stories about her climbing buildings in New York, Chicago, and L.A. I looked closer at one that talked about her climbing the south face of El Capitan on her fourteenth birthday. It had the date.

I looked twice and tried to remember what day of the month it was. I had to count backwards in my head to be sure.

Tomorrow was Mad Molly's birthday.

The Bruce in question was Murry Zapata, outdoor rec guard of the south balcony on the 480th floor. This meant I had to take the birds down 131 stories, or a little over half a kilometer. And then climb back.

Even on the face of Le Bab tower, with a roughing cube or vent or external rail every meter or so, this is a serious climb. Molly's pigeons alone were not

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worth the trip, so I dropped five floors and went to see Lenny.

It's a real pain to climb around Lenny's because nearly every horizontal surface has a plant box or pot on it. So I rappeled down even with him and shouted over to where he was fiddling with a clump of fennel.

"Hey, Lenny. I'm making a run. You got anything for Murry?"

He straightened up. "Yeah, wait a sec." He was wearing shorts and his climbing harness and nothing else. He was brown all over. If I did that sort of thing I'd be a melanoma farm.

Lenny climbed down to his tent and disappeared inside. I worked my way over there, avoiding the plants. I smelled dirt, a rare smell up here. It was an odor rich and textured. It kicked in memories of freshly plowed fields or newly dug graves. When I got to Lenny's tent, he came out with a bag.

"What'cha got," I asked.

He shrugged. "Garlic, cumin, and anise. The weights are marked on the outside. Murry should have no trouble moving it. The Chicanos can't get enough of the garlic. Tell Murry that I'll have some of those tiny *muy caliente* chilis for him next week."

"Got it."

"By the way, Fran said yesterday to tell you she has some daisies ready to go down."

"Check. You ever grow any fruit, Lenny?"

"On these little ledges? I thought about getting a dwarf orange once but decided against it. I grow dew berries but none of them are ripe right now. No way I could grow trees. Last year I grew some cantaloupe but that's too much trouble. You need a bigger bed than I like."

"Oh, well. It was a thought." I added his bag to the pigeons in my pack. "I'll probably be late getting back."

He nodded. "Yeah, I know. Better you than me, though. Last time *I* went, the Howlers stole all my tomatoes. Watch out down below. The Howlers are claiming the entire circumference from 520 to 530."

"Oh, yeah? Just so they don't interfere with my right of eminent domain."

He shrugged. "Just be careful. I don't care if they want a cut. Like maybe a clump of garlic."

I blinked. "Nobody cuts my cargo. Nobody."

"Not even Dactyl?"

"Dactyl's never bothered me. He's just a kid."

Lenny shrugged. "He's sent his share down. You get yourself pushed off and we'll have to find someone else to do the runs. Just be careful."

"Careful is what I do best."

Fran lived around the corner, on the east face. She grew flowers, took in sewing, and did laundry. When she had the daylight for her solar panel, she watched TV.

"Why don't you live inside, Fran. You could watch TV twenty-four hours a day."

She grinned at me, a not unpleasant event. "Nah. Then I'd pork up to about a hundred kilos eating that syntha crap and not getting any exercise and I'd have to have a permit to grow even one flower in my cubicle and a dispensation for the wattage for a grow light and so

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on and so forth. When they put me in a coffin, I want to be dead."

"Hey, they have exercise rooms and indoor tracks and the rec balconies."

"Big deal. Shut up for a second while I see if Bob is still mad at Sue because he found out about Marilyn's connection with her mother's surgeon. When the commercial comes I'll cut and bundle some daisies."

She turned her head back to the flat screen. I looked at her blue bonnets and pansies while I waited.

"There, I was right. Marilyn is sleeping with Sue's mother. That will make everything okay." She tucked the TV in a pocket and prepared the daisies for me. "I'm going to have peonies next week." I laced the wrapped flowers on the outside of the pack to avoid crushing the petals. While I was doing that Fran moved closer. "Stop over on the way back?"

"Maybe," I said. "Of course I'll drop your script off."

She withdrew a little.

"I want to, Fran, honest. But I want to get some fresh fruit for Mad Molly's birthday tomorrow and I don't know where I'll have to go to get it."

She turned away and shrugged. I stood there for a moment, then left, irritated. When I looked back she was watching the TV again.

The Howlers had claimed ten floors and the entire circumference of the Le Bab Tower between those floors. That's an area of forty meters by 250 meters per side or 40,000 square meters total. The tower is over a kilometer on a side at the base but it tapers in stages until its only twenty meters square at three thousand meters.

Their greediness was to my advantage because there's only thirty-five or so Howlers and that's a lot of area to cover. As I rappelled down to 529 I slowly worked my way around the building. There was a bunch of them in hammocks on the south face, sunbathing. I saw one or two on the east face but most of them were on the west face. Only one person was on the north side.

I moved down to 521 on the north face well away from the one guy and doubled my longest line. It was a hundred meter blue line twelve millimeters thick. I coiled it carefully on a roughing cube after wrapping the halfway point of the rope around another roughing cube one complete circuit, each end trailing down. I pushed it close into the building so it wouldn't slip. Then I clipped my brake bars around the doubled line.

The guy at the other corner noticed me now and started working his way from roughing cube to roughing cube, curious. I kicked the rope off the cube and it fell cleanly with no snarls, no snags. He shouted. I jumped, a gloved hand on the rope where it came out of the brake bars. I did the forty meters in five jumps, a total of ten seconds. Halfway down I heard him shout for help and heard others come around the corner. At 518 I braked and swung into the building. The closest Howler was still fifteen meters or so away from my rope, but he was speeding up. I leaned against the building and flicked the right hand rope hard, sending a sinusoidal wave traveling up the line. It reached the top and the now loose rope flicked off the

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cube above and fell. I sat down and braced. A hundred meter rope weighs in at eight kilos and the shock of it pulling up short could have pulled me from the cube.

They shouted things after me, but none of them followed. I heard one of them call out, "Quit'cha bitchin. He's got to pass us on his way home. We'll educate him then."

All the rec guards deal. It's a good job to have if you're inside. Even things that originate inside the tower end up traveling the outside pipeline. Ain't no corridor checks out here. No TV cameras or sniffers either. The Howlers do a lot of that sort of work.

Murry is different from the other guards, though. He doesn't deal slice or spike or any of the other nasty pharmoddities, and he treats us outsiders like humans. He says he was outside once. I believe him.

"So, Murry, what's with your wife? She had that baby yet?"

"Nah. And boy is she tired of being pregnant. She's, like, out to *here*." He held his hands out. "You tell Fran I want something special when she finally dominoes. Like roses."

"Christ, Murry. You know Fran can't do roses. Not in friggin pots. Maybe day lilies. I'll ask her." I sat in my seat harness, hanging outside the cage that's around the rec balcony. Murry stood inside smelling the daisies. There were some kids kicking a soccer ball on the far side of the balcony and several adults standing at the railing looking out through the bars. Several people stared at me. I ignored them.

Murry counted out the script for the load and passed it through the bars. I zipped it in a pocket. Then he pulled out the provisions I'd ordered the last run and I dropped them, item by item, into the pack.

"You ever get any fresh fruit in there, Murray?"

"What do I look like, guy, a millionaire? The guys that get that sort of stuff live up there above 750. Hell, I once had this escort job up to 752 and while the honcho I escorted was talking to the resident, they had me wait out on this patio. This guy had apples and peaches and *cherries* for crissakes! *Cherries!*" He shook his head. 'It was weird, too. None of this cage crap." He rapped on the bars with his fist. "He had a chest high railing and that was it."

"Well of course. What with the barrier at 650 he doesn't have to worry about us. I'll bet there's lots of open balconies up that way." I paused. "Well, I gotta go. I've got a long way to climb."

"Better you than me. Don't forget to tell Fran about the special flowers."

"Right."

They were waiting for me, all the Howlers sitting on the south face, silent, intent. I stopped four stories below 520 and rested. While I rested I coiled my belay line and packed it in my pack. I sat there, fifteen kilos of supplies and climbing paraphernalia on my back, and looked out on the world.

The wind had shifted more to the southwest and was less damp than the morning air. It had also strengthened but the boundary layer created by the rough-

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ing cubes kept the really high winds out from the face of the tower.

Sometime during the day the low clouds below had broken into patches, letting the ground below show through. I perched on the roughing cube, unbelayed and contemplated the fall. 516 is just over two kilometers from the ground. That's quite a drop—though in low winds the odds were I'd smack into one of the rec balconies where the tower widened below. In a decent southerly wind you can depend on hitting the swamps instead.

What I had to do now was rough.

I had to free ascend.

No ropes, no nets, no second chances. If I lost it the only thing I had to worry about was whether or not to scream on the way down.

The Howlers were not going to leave me time for the niceties.

For the most part the Howlers were so-so climbers, but they had a few people capable of technical ascents. I had to separate the good from the bad and then out-climb the good.

I stood on the roughing cube and started off at a run, leaping two meters at a time from roughing cube to roughing cube moving sideways across the south face. Above me I heard shouts but I didn't look up. I didn't dare. The mind was blank, letting the body do the work without hindrance. The eyes saw, the body did, the mind coasted.

I slowed as I neared the corner, and stopped, nearly falling when I overbalanced, but saving myself by dropping my center of gravity.

There weren't nearly as many of them above me now. Maybe six of them had kept up with me. The others were trying to do it by the numbers, roping from point to point. I climbed two stories quickly, chimneying between a disused fractional distillation stack and a cooling tower. Then I moved around the corner and ran again.

When I stopped to move up two more stories there were only two of them above me. The other four were trying for more altitude rather than trying to keep pace horizontally.

I ran almost to the northwest corner, then moved straight up.

The first one decided to drop kick me dear Jesus through the goal posts of life. He pulled his line out, fixed it to something convenient and rappelled out with big jumps, planning, no doubt, to come swinging into me with his feet when he reached my level. I ignored him until the last minute when I let myself collapse onto a roughing cube. His feet slammed into the wall above me then rebounded out.

As he swung back out from the face I leaped after him.

His face went white. Whatever he was expecting me to do, he wasn't expecting *that!* I latched onto him like a monkey, my legs going around his waist. One of my hands grabbed his rope, the other punched with all my might into his face. I felt his jaw go and his body went slack. He released the rope below the brake bars and started sliding down the rope. I scissored him with my legs and held onto the rope with both hands. My shoulders creaked as I took the strain but he stopped sliding. Then we swung back into the wall and I sagged onto a cube astride him.

His buddy was dropping down more slowly. He was belayed but he'd seen

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what I'd done and wasn't going to try the airborne approach. He was still a floor or two above me so I tied his friend off so he wouldn't sleepwalk and took off sideways, running again.

I heard him shout but I didn't hear him moving. When I paused again he was bent over my friend with the broken jaw. I reached an external exhaust duct and headed for the sky as fast as I could climb.

At this point I was halfway through Howler territory. Off to my right the group that had opted for height was now moving sideways to cut me off. I kept climbing, breathing hard now but not desperate. I could climb at my current speed for another half hour without a break and I thought there was only one other outsider that could keep up that sort of pace. I wondered if he was up above.

I looked.

He was.

He wasn't on the wall.

He didn't seem to be roped on.

And he was dropping.

I tried to throw myself to the side, in the only direction I could go, but I was only partially successful. His foot caught me a glancing blow to my head and I fell three meters to the next roughing cube. I landed hard on the cube, staggered, bumped into the wall, and fell outward, off the cube. The drop was sudden, gut wrenching, and terrifying. I caught the edge of the cube with both hands, wrenching my shoulders and banging my elbow. My head ached, the sky spun in circles and I knew that there was over a kilometer of empty space beneath my feet.

Dactyl had stopped somehow, several stories below me, and, as I hung there, I could see the metallic gleam of some sort of wire, stretched taut down the face of the tower.

I chinned myself up onto the cube and traversed away from the wire, moving and climbing fast. I ignored the pain in my shoulders and the throbbing of my head and even the stomach churning fear and sudden clammy sweat.

There was a whirring sound and the hint of movement behind me. I turned around and caught the flash of gray moving up the face. I looked up.

He was waiting, up on the edge of Howler territory, just watching. Closer were the three clowns who were trying to get above me before I passed them. I eyed the gap, thought about it, and then went into overdrive. They didn't make it. I passed them before they reached the exhaust duct. For a few stories they tried to pursue and one of them even threw a grapple that fell short.

That left only Dactyl.

He was directly overhead when I reached 530. I paused and glanced down. The others had stopped and were looking up. Even the clothesliners had made it around the corner and were watching. I looked back up. Dactyl moved aside about five meters and sat down on a ledge. I climbed up even with him and sat too.

Dactyl showed up one day in the middle of Howler territory. Three Howlers took the long dive before it was decided that maybe the Howler should ignore Dactyl before there were no Howlers left. He's a loner who does a mixed bag: some free ascent, some rope work, and some fancy mech stuff.

There was something about him that

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made him hard to see, almost. Not really, but he did blend into the building. His nylons, his climbing shoes, his harness were gray like the roughing cube he sat on. His harness was strung with gray boxes and pouches of varying sizes, front and back, giving his torso a bulky appearance, sort of like a turtle with long arms. He was younger than I'd thought he'd be, perhaps twenty, but then I'd only seen him at a distance before now. His eyes looked straight at me, steady and hard. He wasn't sweating a bit.

"Why?" I said.

He shrugged. "Be natural, become a part of your environment. Who said that?"

"Lot's of people said that. Even I said that."

Dactyl nodded. "So, like I'm doing that thing. I'm becoming a part of the environment. One thing you should know by now, dude . . ."

"What's that?" I asked warily.

"The environment is hostile."

I looked out, away from him. In the far distance I saw white sails in Galveston bay. I turned back. "What did I ever do to you?"

He smiled. "You take it too personal. It's more random than that. Think of me as an extra-somatic evolutionary factor. You've got to evolve. You've got to adapt. *Mano a Mano* shit like that."

I let that stew for a while. The Howlers were gathering below, inside their territory. They were discussing something with much hand waving and punctuated gestures.

"So," I finally said. "You ever walk through downtown Houston?"

He blinked, opened his mouth to say something, then closed it. Finally, almost unwillingly, he said, "On the ground? No. They eat people down there."

I shrugged. "Sometimes they do. Sometimes they don't. Last time I was in Tranquillity Park they were eating alligator tail with Siamese peanut sauce. Except when the alligators were eating them."

"Oh."

"You even been down below at all?"

"I was born inside."

"Well, don't let it bother you," I said as I stood up.

He frowned slightly. "What's that supposed to mean?"

I grinned. "It's not where you were born that matters," I said. "It's where you die."

I started climbing.

The first half-hour was evenly paced. He waited about a minute before he started after me and for the the next seventy floors it was as if there was an invisible fifteen meter rope stretched between us. About 600 he lowered the gap to ten meters. I picked up the pace a little, but the gap stayed the same for the next ten floors.

I was breathing hard now and feeling the burn in my thighs and arms. My clothes were soaked in sweat but my hands were dry and I was in rhythm, climbing smooth and steady.

Dactyl was also climbing fast, but jerky, his movements inefficient. The gap was still ten meters but I could tell he was straining.

I doubled my speed.

The universe contracted. There was only the wall, the next purchase, the

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next breath. There were no peaches, no birthdays, no flowers, and no Dactyl. There was no thought.

But there *was* pain.

My thighs went from burning to screaming. I started taking up some of the slack with my arms and they joined the chorus. I climbed through the red haze for fifteen more stories and then collapsed on a roughing cube.

The world reeled as I gasped for the first breaths. I felt incipient cramps lurking in my thighs and I wanted those muscle cells to have all the oxygen I could give them. Then, as the universe steadied, I looked down for Dactyl.

He wasn't on the north face.

Had he given up?

I didn't know and it bothered me.

Five stories above was the barrier—a black, ten meter overhang perpendicular to the face. It was perfectly smooth, made of metal, its welds ground flush. I didn't know what was above it. There were rumors about automatic lasers, armed guards, and computer monitored imaging devices. I'd worry about them when I got past that overhang.

I was two stories short of it when Dactyl appeared at the northeast corner of the building.

Above me.

It wasn't possible. I almost quit then but something made me go on. I tried to blank my mind and began running toward the west face, doing the squirrel hopping from block to block, even though my muscles weren't up to it. I almost lost it twice, once when my mind dwelt too much on how Dactyl had passed me and once when my quadriceps gave way.

I stopped at the corner, gasping, and looked back. Dactyl was working his way leisurely after me, slowly, almost labored. I ducked around and climbed again, until I was crouched on a roughing cube, the dark overhang touching my head. I peeked around the corner. Dactyl had paused, apparently resting.

I took off my pack and pulled out a thirty-meter length of two-ton-test line, a half-meter piece of ten-kilo-test monofilament, and a grapple. I tied the monofilament between the heavier line and the grapple.

I peeked around the corner again. Dactyl was moving again, but slowly, carefully. He was still two-hundred meters across the face. I dropped down two meters and stepped back around the corner. Dactyl stopped when he saw me, but I ignored him, playing out the grapple and line until it hung about fifteen meters below me. Then I started swinging it.

It was hard work, tricky, too. I didn't think I had the time to rig a quick belay before Dactyl got there. At least the grapple was light, three kilos at most, but as it swung wider and wider it threatened to pull me off at each end of its swing, especially as the corner formed by the barrier concentrated the wind somewhat.

Finally the grapple raised far enough on the swing away from the corner. As it dropped to the bottom of its swing I began pulling it in. As the moment arm decreased the grapple sped up, gaining enough speed to flip up above the edge of the overhang. I had no idea how thick the overhang was or even if there was something up there for the grapple to catch on. I held my breath.

There was a distant clinking noise as

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it struck something and the rope slackened. For an instant I thought it was dropping back down and I was scared because I was already off balance and I didn't know how far Dactyl was behind me. Then the rope stopped moving and the grapple didn't drop into sight.

I risked a quick look behind. Dactyl was still a hundred meters away. I took the rope and moved back around the corner, pulling the rope cautiously tight. As luck would have it, with the line pulled over, Dactyl wouldn't be able to see any part of the rope until he rounded the corner.

It took me two minutes to tie the lower end of the rope around a roughing cube and then to two more cubes for backup. Then I recklessly dropped from cube to cube until I was three stories down and hidden behind a Bernoulli exhaust vent.

He stuck his head around the corner almost immediately. Saw the dangling line and tugged it hard. The ten-kilo test line hidden above the barrier held. Dactyl clipped a beaner over the line and leaped out, almost like a flying squirrel, his hands reaching for the rope. He was halfway out before his full weight hit the rope.

The ten kilo test snapped immediately. I heard his indrawn breath, but he didn't swear. Instead, as he arched down, he tried to twist around, to get his legs between him and the face as he swung into it.

He was only partially successful, slamming hard into the corner of a roughing cube, one leg taking some of the shock. I heard the breath leave his lungs in an explosive grunt and then he was sliding down the rope toward the unattached end, grabbing weakly to stop himself, but only managing to slow the drop.

I moved like a striking snake.

I was already lower down the tower from where he'd hit the wall and took three giant strides from cube to cube to get directly beneath him. Then he was off the end of the rope and dropping free and my hand reached out, snared his climbing harness, and I flattened myself atop the cube I was on.

For the second time that day I nearly dislocated my shoulder. His weight nearly pulled me off the tower. The back of my shirt suddenly split. I heard his head crack onto the cube and he felt like a sack of dirt, lifeless, but heavy as the world.

It took some time to get him safely onto the cube and lashed in place.

It took even longer to get my second grapple up where the first one was. It seemed my first attempt was a fluke and I had to repeat the tiring process six more times before I could clip my ascenders to the rope and inchworm up it.

The building had narrowed above the barrier, to something like 150 meters per side. I was on the edge of a terrace running around the building. Unlike the recreation balconies below, it was open to the sky, uncaged, with only a chest high railing to contain its occupants. Scattered artfully across the patio were lounge chairs and greenery topped planters.

I saw a small crowd of formally dressed men and women mingling on the west terrace, sheltered from the northeast wind. Servants moved among

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them with trays. Cocktail hour among the rich, the influential, and the cloudy.

I pulled myself quickly over the edge and crouched behind a planter, pulling my rope in and folding my grapples.

The terrace areas unsheltered by the wind seemed to be deserted. I looked for cameras and IR reflectors and capcitance wires but I didn't see any. I couldn't see any reason for any.

Above me, the face of the tower rose another five hundred meters or so, but unlike the faces below, there were individual balconies spotted here and there among the roughing cubes. On more than one I could see growing plants, even trees.

I had more that a hundred floors to go, perhaps 400 meters.

My arms and legs were trembling. There was a sharp pain in the shoulder Dactyl had kicked, making it hard for me to lift that arm higher than my neck.

I nearly gave it up. I thought about putting down my pack, unbuckling my climbing harness, and stretching out on one of these lounge chairs. Perhaps later I'd take a drink off of one of those trays.

Then a guard would come and escort me all the way to the ground.

Besides, I could do a hundred stories standing on my head, right? Right.

The sun was completely down by the time I reached 700 but lights from the building itself gave me what I couldn't make out by feel. The balconies were fancy, sheltered from the wind by removable fairings and jutting fins. I kept my eye out for a balcony with fruit trees, just in case. I wouldn't climb all the way up to 752 if I didn't have to.

But I had to.

There were only four balconies on 752, one to each side. They were the largest private balconies I'd ever seen on the tower. Only one of them had anything resembling a garden. I spent five minutes looking over the edge at planter after planter of vegetables, flowers, shrubs, and trees. I couldn't see any lights through the glass doors leading into the building and I couldn't see any peaches.

I sighed and pulled myself over the edge for a closer look, standing upright with difficulty. My limbs were leaden, my breath still labored. I could hear my pulse thudding in my ears, and I still couldn't see any peaches.

There were some green oranges on a tree near me, but that was the closest thing to fruit I could see. I shivered. I was almost two kilometers above sea level and the sun had gone down an hour ago. My sweat soaked clothes were starting to chill.

Something was nagging me and, at first, the fatigue toxins wouldn't let me think clearly. Then an important fact swam into my attention.

I hadn't checked for alarms.

They were there, in the wall above the railing, a series of small reflectors for the I/R beams that I'd crawled through to enter the balcony.

Time to leave. Long past time. I stepped toward the railing and heard a door open behind me. I started to swing my leg up over the edge when I felt something stick me in the side. And then the universe exploded.

All the muscles on my right side convulsed spasmodically and I came down onto the concrete floor with a crash, slamming my shoulder and hip into the

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ground. My head was saved from the same fate by the backpack I wore.

Taser, I thought.

When I could focus, I saw the man standing about three meters away, wearing a white khaftan. He was older than I was by decades. Most of his hair was gone and his face had deep lines etched by something other than smiling. I couldn't help comparing him to Mad Molly, but it just wasn't the same. Mad Molly could be as old but she didn't look anywhere as *nasty* as this guy did.

He held the taser loosely in his right hand. In his left hand he held a drink with ice that he swirled gently around, clink, clink.

"What are you doing here, you disgusting little fly?"

His voice, as he asked the question, was vehement and acid. His expression didn't change though.

"Nothing." I tried to say it strongly, firmly, reasonably. It came out like a frog's croak.

He shot me with the taser again. I caught the glint on the wire as it sped out, tried to dodge, but too late.

I arched over the backpack, my muscles doing things I wouldn't have believed possible. My head banged sharply against the floor. Then it stopped again.

I was disoriented, the room spun. My legs decided to go into a massive cramp. I gasped out loud.

This seemed to please him.

"Who sent you? I'll know in the end. I can do this all night long."

I said quickly, "Nobody sent me. I hoped to get some peaches."

He shot me again.

I really didn't think much of this turn of events. My muscles had built up enough lactic acid without electro-convulsive induced contractions. When everything settled down again I had another bump on my head and more cramps.

He took a sip from his drink.

"You'll have to do better than that," he said. "Nobody would risk climbing the outside for peaches. Besides, there won't be peaches on that tree for another five months." He pointed the taser. "Who sent you?"

I couldn't even talk at this point. He seemed to realize this, fortunately, and waited a few moments, lowering the taser. Then he asked again, "Who sent you?"

"Get stuffed," I told him weakly.

"Stupid little man." He lifted the taser again and something smashed him in the arm, causing him to drop the weapon. He stooped to pick it up again but there was a streak of gray and the thud of full body contact as someone hit him and bowled him over onto his back.

I saw the newcomer scoop up the taser and spin sharply. The taser passed over my head and out over the railing.

It was Dactyl.

The man in the khaftan saw Dactyl's face then and said, "You!" He started to scramble to his feet. Dactyl took one sliding step forward and kicked him in the face. The man collapsed in a small heap, his khaftan making him look like a white sack with limbs sticking out.

Dactyl stood there for a moment looking down. Then he turned and walked slowly back to me.

"That was a nasty trick with the rope."

I laughed, albeit weakly. "If you weren't so lazy you would have made

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your own way up." I eyed him warily, but my body wasn't up to movement yet. Was he going to kick me in the face, too? Still, I had to know something. "How did you pass me down there, below the barrier? You were exhausted, I could see it."

He shrugged. "You're right. I'm lazy." He flipped a device off his back. It looked like a gun with two triggers. I made ready to jump. He pointed it up and pulled the trigger. I heard a *chunk* and something buried itself in the ceiling. He pulled the second trigger and there was a whining sound. Dactyl and gun floated off the floor. I looked closer and saw the wire.

"Cheater," I said.

He laughed and lowered himself back to the floor. "What the hell are you doing here?" he asked.

I told him.

"You're shitting me."

"No."

He laughed then and walked briskly through the door into the tower.

I struggled to stand. Made it. I was leaning against the railing when Dactyl came back through the door with a plastic two-liter container. He handed it to me. It was ice cold.

"What's this?"

"Last season's peaches. From the freezer. He always hoards them until just before the fresh ones are ready."

I stared at him. "How the hell did you know that?"

He shrugged, took the peaches out of my hand and put them in my pack. "Look, I'd get out of here before he wakes up. Not only does he have a lot nastier things than that taser, but security will do whatever he wants."

He swung up over the edge and lowered himself to arm's length. Just before he dropped completely from sight he added something which floated up with the wind.

"He's my father."

I started down the tower not too long after Dactyl. Physically I was a wreck. The taser had exhausted my muscles in a way that exercise never had. I probably wasn't in the best shape to do any kind of rope work, but Dactyl's words rang true. I didn't want anybody after me in the condition I was in, much less security.

Security is bad. They use copters and rail cars that run up and down the outside of the building. They fire rubber bullets and water cannon. Don't think this makes them humane. A person blasted off a ledge by either is going to die. Security is just careful not to damage the tower.

So, I did my descent in stages, feeling like an old man tottering carefully down a flight of stairs. Still, descent was far easier than ascent, and my rope work had me down on the barrier patio in less than ten minutes.

It was nearing midnight, actually lighter now that the quarter moon had risen, and the patio, instead of being deserted, had far more people on it than it had at sunset. A few people saw me coiling my rope after my last rappel. I ignored them, going about my business with as much *panache* as I could muster. On my way to the edge of the balcony I stopped at the buffet and built myself a sandwich.

More people began looking my way and talking. An elderly woman standing

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at one end of the buffet took a long look at me, then said, "Try the wontons. I think there's really pork in them."

I smiled at her. "I don't know. Pork is tricky. You never know who provided it."

Her hand stopped, a wonton halfway to her mouth, and stared at me. Then, almost defiantly, she popped it into her mouth and chewed it with relish. "Just so it's well cooked."

A white clad steward left the end of the table and walked over to a phone hanging by a door.

I took my sandwich over to the edge and set it down while I took the rope from the pack. My legs trembled slightly. The woman with the wontons followed me over after a minute.

"Here," she said, holding out a tall glass that clinked. "Ice tea."

I blinked, surprised. "Why, thank you. This is uncommonly kind."

She shrugged. "You look like you need it. Are you going to collapse right here? It would be exciting, but I'd avoid it if I were you. I think that nasty man called security."

"Do I look as bad as all that?"

"Honey, you look like death warmed over."

I finished playing out the rope and clipped on my brake-bars. "I'm afraid you're right." I took a bite out of the sandwich and chewed quickly. I washed it down with the tea. It wasn't one of Mad Molly's roast pigeons but it wasn't garbage, either.

"You'll get indigestion," the woman warned.

I smiled and took another large bite. The crowd of people staring at me was getting bigger. There was a stirring in the crowd from over by the door. I took another bite and another swig, then swung over the edge. "We must do this again, sometime," I said. "Next time, we'll dance."

I dropped into the dark, jumping out so I could swing into the building. I didn't reach it on the first swing, so I let out more rope and pumped my legs. I came within a yard of the tower and swung out again. I felt better than before but was still weak. I looked up and saw heads looking over the edge at me. Something gleamed in the moonlight.

A knife?

I reached the wall and dropped onto a roughing cube, unbalanced, unsure of my purchase. For a moment I teetered, then was able to heave myself in toward the wall, safe. I turned, to release one end of the rope, so I could snake it down from above.

I didn't have to. It fell from above, two new ends whipping through the night air.

Bastards. I almost shouted it, but it seemed better to let them think I'd fallen. Besides, I couldn't be bothered with any action so energetic. I was bone weary, tired beyond reaction.

For the next hundred stories I made like a spider with arthritis, slow careful descents with lengthy rests. After falling asleep and nearly falling off a cube, I belayed myself during all rest stops. At one point I'm sure I slept for over an hour because my muscles had set up, stiff and sore. It took me another half hour of careful motion before I was moving smoothly again.

Finally I reached Mad Molly's, moving carefully, quietly. I unloaded her supplies and the peaches and put them

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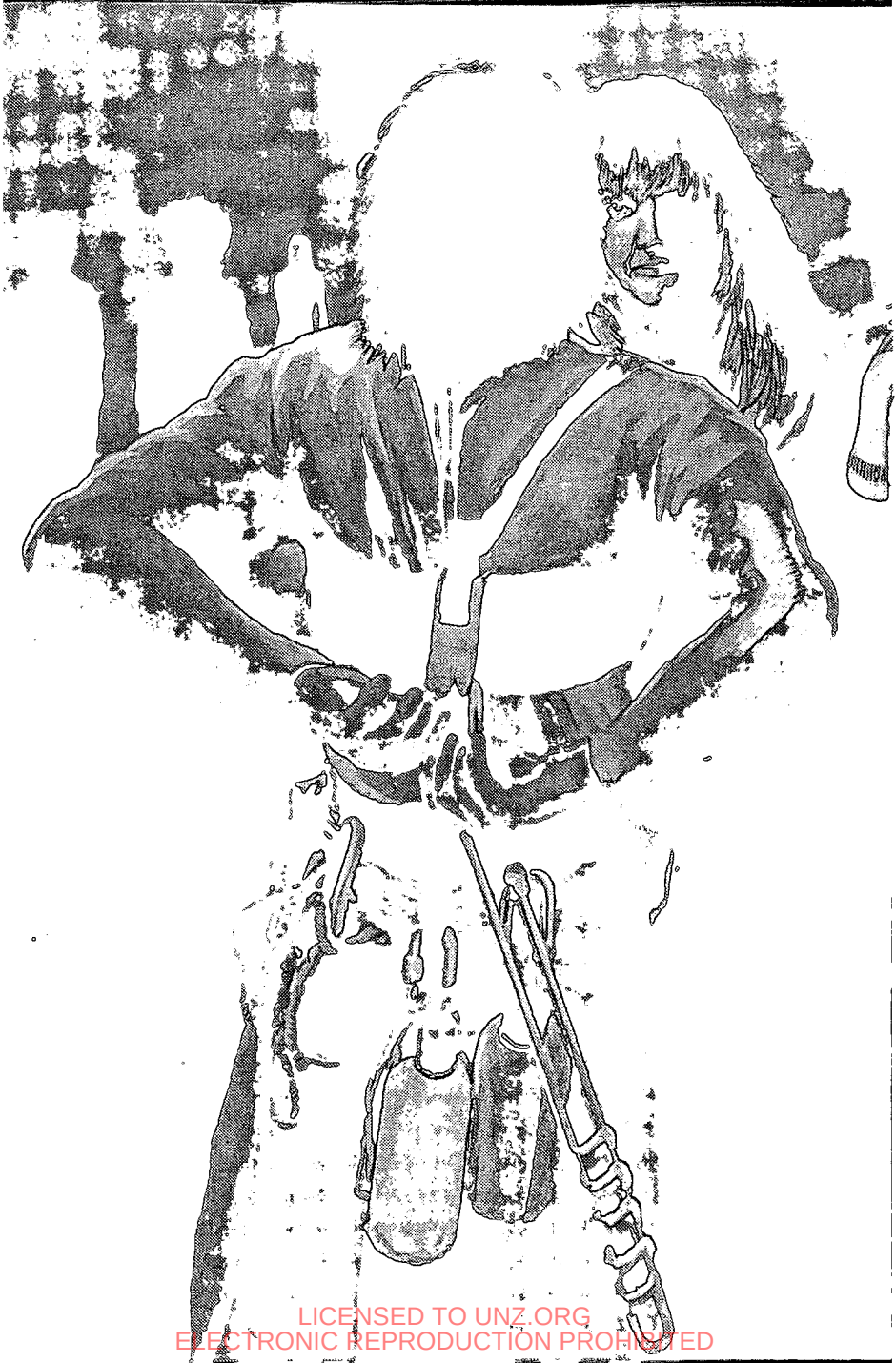

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carefully inside her door. I could hear her snoring. Then, leaving my stash under her house as usual, I climbed down, intending to see Fran and make her breakfast.

I didn't make it to Fran's.

In the half dark before the dawn they came at me.

This is the place for a good line like "they came on me like the wolf upon the fold" or "as the piranha swarm." Forget it. I was too tired. All I know is they came at me, the Howlers did. At me, who'd been beaten, electroshocked, indigested, sliced at, and bone wearified; if there exists such a verb. I watched them come in dull amazement, which is not a suit of clothes, but an amalgam of fatigue and astonished reaction to the last straw on my camellian back.

Before I'd been hurt and felt the need to ignore it. I'd been challenged and felt the need to respond. I'd felt curiosity and felt the need to satisfy it. I'd felt fear and the need to overcome it. But I hadn't yet felt what I felt now.

I felt rage, and the need to express it.

I'm sure the first two cleared the recreation balcony, they had to. They came at me fast unbelayed and I used every bit of their momentum to heave them out. The next one, doubtless feeling clever, landed on my back and clung like a monkey. I'd passed caring, I simply threw myself to the side, aiming my back at the roughing cube two meters below. He tried, but he didn't get off in time. I'm grateful though, because the shock would have broken my back if he hadn't been there.

I don't think he cleared the rec balcony.

I ran then, but slowly, so angry that I wanted them to catch up, to let me use my fists and feet on their stubborn, malicious, stupid heads. For the next ten minutes it was a running battle only I ran out of steam before they ran out of Howlers.

I ended up backed into a cranny where a cooling vent formed a ledge some five meters deep and four meters wide, when Dactyl dropped into the midst of them, a gray blur that sent three of them for a dive and two more scrambling back around the edges.

I was over feeling mad by then and back to just feeling tired.

Dactyl looked a little tired himself. "I can't let you out of my sight for a minute, can I?" he said. "What's the matter? You get tired of their shit?"

"Right . . ." I laughed weakly. "Now I'm back to owing *you*."

"That's right, suck-foot. And I'm not going to let you forget it."

I tottered forward then and looked at the faces around us. I didn't feel so good.

"Uh, Dacty."

"Yeah."

"I think you better take a look over the edge."

He walked casually forward and took a look down, then to both sides, then up. He backed up again.

"Looks like you're going to get that chance to repay me real soon," he said.

The Howlers were out there—all of the Howlers still alive—every last one of them. In the predawn gray they were climbing steadily toward us from all

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sides, as thick as cannibals at a funeral. I didn't think much of our chances.

"Uh, Dactyl?"

"Yeah."

"Do you think that piton gun of yours can get us out of here?"

He shook his head. "I don't have anything to shoot into. The angles are all wrong."

"Oh."

He tilted his head then and said, "I do have a parachute."

"What?"

He showed me a gray bundle connected to the back of his climbing harness between batteries.

"You ever use it?"

"Do I look crazy?" he asked.

I took a nine meter length of my strongest line and snapped one end to my harness and the other to his.

The Howlers were starting to come over the lip.

"The answer is yes," I said.

We started running.

I took two of them off with me, and Dactyl seemed to have kicked one man right in the face. The line stretched between us pulled another one into the void. I was falling, bodies tumbling around me in the air, the recreation deck growing in size. I kept waiting for Dactyl to open the chute but we seemed to fall forever. Now I could see the broken Howlers who'd preceded us, draped on the cage work over the balcony. The wind was a shrieking banshee in my ears. The sun rose. I thought, *here I am falling to my death and the bloody sun comes up!*

In the bright light of the dawn a silken flower blossomed from Dactyl's back. I watched him float up away from me and then the chute opened with a dull boom. He jerked up away from me and there came a sudden, numbing shock. Suddenly I was dangling at the end of a three meter pendulum, tick, tick and watching four more bodies crash into the cage.

The wind took us then, far out, away from the tower, spinning slowly as we dropped. I found myself wondering if we'd land on water or land.

Getting out of the swamp, past alligators and cannibals, and through the Le Bab Security perimeter is a story in itself. It was hard, it took some time, but we did it.

While we were gone there was a shakeup in the way of things. Between my trespassing and Howlers dropping out of the sky, the Security people were riled up enough to come out and "shake off" some of the fleas. Fortunately most of the victims were Howlers.

To finish this story up neatly I would like to add that Molly liked the peaches—but she didn't.

It figures. ■

● It's important to keep an open mind, but not so open that your brains fall out.

Stephen A. Kallis, Jr.

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The Alternate View

STARTING THE FIRES

G. Harry Stine

The commercial space launch vehicle industry shows encouraging signs of actually coming alive. The bleak picture I painted in my article, "The Dream Is Down," in the February 1987 issue isn't quite as bleak today. The space launch capability crisis and its potential consequences and opportunities were seen by many other people, and they've reacted to the situation in the classical American spirit of private enterprise. So herewith a report gleaned from attending the Space & Telecommunications Symposium held in Houston in early June 1987, and from information that's become available in the thirty days since.

Martin-Marietta is "commercializing" the *Titan-III/IV* launch vehicle developed in the 1960s for the U.S. Air Force and subsequently used several times by NASA. However, the pretty brochures I've got were put together by aerospace engineers for the benefit of other aerospace engineers; they contain little information on actual lift capabilities and absolutely zero data in cost and availability that are of interest to CEOs and company comptrollers. Price still runs in the neighborhood of $150 million per launch, but you've got to negotiate final costs and delivery schedule.

General Dynamics announced that it's reopening the Atlas-Centaur production line to build 18 birds on spec. GD is swallowing the $100 million required to restart the production line, but you can bet they plan to recoup that if they sell enough birds. Price is quoted as "about $80 million per launch."

McDonnell Douglas has Delta vehicles rolling out the doors of a new plant near Pueblo, Colorado. MacDac says they can produce as many as 18 Deltas per year and could produce more if Rockwell International's Rocketdyne Division could make the engines fast enough. Price hovers between $50 million and $80 million each.

Most of us private space enthusiasts fully expected a response such as this from the existing aerospace industry. We also guessed rightly that these outfits would continue to market their boosters in the same way they've been doing it all these years when they had only one customer: the United States government in the form of NASA and USAF. And they're building the same birds that they've always built. As a matter of fact, the sons of the original engineers are now working on those birds! Delta is basically the *USAF Thor IRBM*. *Atlas-Centaur* is the *USAF Atlas ICBM*. *Titan-III/IV* is basically the *USAF Titan II ICBM*. All three vehicles were designed in the late 1950s and became operational by 1960.

However, the continued use of these old converted military ballistic missiles is *not* what I've been talking about when I say we must utilize existing technology. These birds are basically ICBM's

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built to MIL and NASA specs and with government procurement and inspection procedures—which is the expensive way to do it because cost is no factor.

I had a bit of a set-to on the speakers' platform during the Houston meeting with an advanced planner from NASA who spoke as if the space shuttle was *the* U.S. space transportation system and that NASA was still the sole purveyor of launch services in the U.S.A. (In short, NASA's thinking hasn't changed in spite of presidential directives and the hard realities of the commercial world.) The NASA man talked about achieving 0.95 reliability; he got upset when I pointed out that I did not want 0.95 reliability or even 0.99 reliability and not even the legendary nine-nines reliability when I taxi my airplane onto the runway for takeoff and put the throttle to the gate. I advised him that he wouldn't get aboard any commercial airliner with 0.95 reliability, either. Then we were told that safety and reliability were the foremost considerations of any space transportation system and that cost was of no concern, which caused many businessmen in the audience to get red in the face and make some very acidic comments.

All of which leads me to the conclusion that it's quite probable that neither NASA nor the existing aerospace industry will be factors in the growing commercial space launch industry. They've had a third of a century to put their act together and haven't done it; furthermore, they've lost touch with the real world of business, if they ever had it in the first place.

People have accused me of NASA-bashing. They're right. I've been bashing NASA for the last ten years or so because even then many of us could see that NASA wasn't doing things right and wouldn't listen. I've kept at it because I could; I've had no NASA contracts. There's another reason:

The history of high-tech transportation systems over the past 200 years contains an important lesson.

When canals became the latest high-tech, one might have expected that the existing ocean-going ship builders and operators would have been the ones to build and operate canals because they had the expertise and the technology; but they didn't. The canals or the canal barges were instead created by a totally new industry that grew from scratch.

In turn, when the railroads came along, it was obvious that the canal companies had the earth-moving technology and expertise to build and operate the railroads, but they didn't; an entirely new railroad industry sprang up. In fact, the very best railway steam locomotives in America were built by a company started by Matthias Baldwin, who was a *jeweler*.

When the gasoline-powered wagon known as the automobile truck came along, the railroad industry was in the best position to capitalize on this new transportation system because it possessed the manufacturing technology and expertise in running complex systems, but it didn't end up that way; totally new automotive production and road-building industries grew from entrepreneurs with no railroad background at all.

And when the airplane came along, the same thing happened. It was obvious that the automobile industry had the

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technological know-how, the production expertise, and the operational experience to run that new system. Granted, Ford and General Motors built some airplanes, and the Ford 4-AT Trimotor was an example of this. However, the aircraft manufacturing industry and the airline business were developed by totally new companies having few if any roots in the automotive business.

The existing aerospace launch industry today is reminiscent of the early aviation industry with Ford and GM building airplanes and operating airlines. It's called the "aerospace" industry because the word was coined by Colonel William O. Davis while he was with the USAF Office of Scientific Research in response to an Air Force desire for a word indicating that spacecraft were nothing more than super-sophisticated higher-flying aircraft. For thirty-plus years, the aerospace industry has been trying to serve as the space industry.

It hasn't worked in the past, and it won't work that way in the future, either.

We'll see a totally new space launch industry arise. It will be made up of companies no one has ever heard of before, and run by people no one in the existing aerospace industry knows. They'll be looked upon as upstarts, amateurs, and people "who have no business getting involved in this very complex activity; after all, we in the aerospace industry have been building spacecraft for thirty years, and we know how to do it."

Indeed, this is happening.

It was triggered by President Reagan's announcement on August 15, 1986 that NASA would no longer launch commercial spacecraft. The Department of Commerce later announced it would no longer depend on NASA to launch its weather satellites but would deal directly with the launch vehicle companies themselves. The Air Force, never a NASA-lover, has been doing this for years and is delighted to be freed of dependence upon the NASA space shuttle.

The presidential order has largely been ignored by NASA, which continues to discover "exceptions" to the ruling. But it was carefully noted by those who were willing to take the risk of developing new space launch vehicles to satisfy a market of customers who'd lost their rides on the space shuttle.

Many things I've reported to you in past columns and articles continue to take place. The People's Republic of China is indeed marketing their *Long March* vehicles internationally and have signed up at least three customers. The European *Ariane* is still booked solid through 1992, and Arianespace CEO Frederic d'Allest states that production rates will not be increased. The USSR is aggressively (how else would they do it?) trying to market their *Proton,* and I received confirmation from a very high source indeed that a letter of agreement exists between Intelsat and *Glavkosmos* for the launching of the Intelsat 6 satellites on *Protons;* Houston attorney Art Dula heads up Commercial Space, Inc., which is the U.S. marketing agent for *Glavkosmos*.

(Art, no Soviet-lover and a staunch private enterprise advocate, publicly admits this arrangement with the Soviets is an interim measure to assure a tem-

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porary commercial heavy-lift launch capability until larger and less expensive Western boosters become available. Otherwise, he points out, a lot of companies are going to go bankrupt because they can't launch their satellites.)

Pacific American Launch Services in Redwood City, California has gotten the venture capital to start cutting metal on its Liberty II "big dumb booster."

Space Services, Inc. in Houston has customers for its Conestoga launch vehicle. Space Data Corporation says they'll be happy to start bending tin on the Conestoga as soon as an order for three birds comes from SSI.

In February 1987, a group of aerospace engineers in the Florida area formed E-Prime Aerospace Corporation (EPAC) to build a series of solid-propellant space launch vehicles. The first looks like an up-rated NASA Scout. Another looks very much like the SSI Conestoga. Whether or not this group of aerospace engineers will be able to turn EPAC into a success remains to be seen, especially in light of the historical evidence discussed above.

And American Rocket Company under George Koopman has fire coming out of full-sized test engines. AMROC, a privately funded company, is using the old Thor test stand at Edwards Air Force Base under an agreement with the USAF, and has fired full-scale versions of their hybrid rocket motor module—it uses a rubber-based fuel and liquid oxygen. They plan to launch the first of their Industrial Launch Vehicles (ILVs) from Vandenberg Air Force Base in the fall of 1988.

So fires have been started under new commercial launch vehicles, folks. The horse race has begun. Now maybe we'll see which horse wins. Watch this space for further developments. . . . ■

●Whatever this universe is, it's very large and very complicated, and it's very unlikely we can contain even a fair-sized part of it in our intellects. The size of the universe depresses many people, but not me, I'm delighted at it. Every time someone finds new immensity, I think: *What a place to be . . . !*

J.B. Priestley

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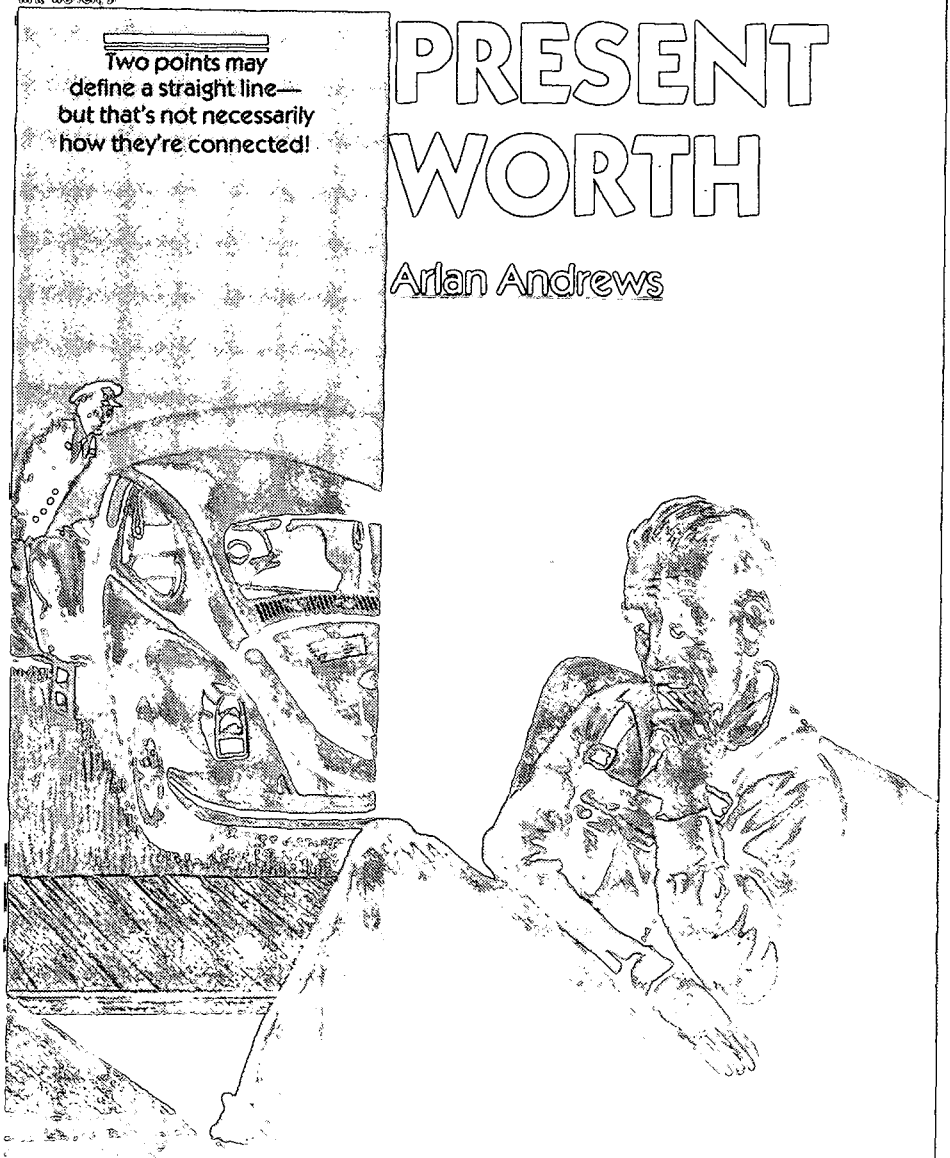
PRESENT WORTH

Arlan Andrews



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General Sammons frowned as he read the terse message from the clattering Teletype machine. He ripped off the still-advancing yellow paper and took it straight to President Truman. As the president read the "Eyes Only" communication from Los Alamos, the General's eyes fell on Truman's favorite desk sign. *The Buck Stops Here,* it said. The General was glad he didn't have his boss's job!

"So let me get this straight, General," Harry Truman said in his nasal twang. "When the atom bomb explodes, the scientists think they can blow a man up into the future? Forty or fifty years? Whatever for?" He shook his grey head and went to his cabinet for a shot of bourbon. The General happily accepted the proffered drink. "Now, if that damned Bomb works, I don't doubt the atom boys can do the time travel thing, too, but why risk that boy's life? He is just a junior officer, isn't he?"

"Sir, Major Lyles is a volunteer," the General replied between sips of the strong drink, "and he is fully ready to risk his life for a glimpse into the future. A strategic look, you might say, sir."

"Strategic? How so?"

"The Major can look around, find out what happens in this war—how soon do we win? Do the Germans really have a redoubt somewhere for a counterattack? Maybe their own atomic bombs?" That last comment worried both men. They just couldn't believe that Hitler was really dead and the Third Reich gone. Too many stories still circulated about secret vengeance weapons. Their nightmare was an atom bomb aboard a super-V2, announcing Germany's reentry into the war. That, plus certain reports that the Japs were working on atom bombs, too.

"Sir, a look at the future would settle all our doubts." He spoke slowly, deliberately. "Wouldn't you like to know if we should use the Bomb?"

Truman took the small remaining portion of his drink at one gulp. "I don't need much push in that direction, General. I remember Pearl Harbor and the Bataan Death March. I've read the reports about Jap atrocities in China and the Pacific. Don't reckon we can hurt them enough, in my book. I only wish we would have had this bomb in time to use it on Berlin six months ago!"

Weeks passed. Truman was in Yalta with Churchill and Stalin, and General Sammons commanded the secret Teletype terminal in the White House. On a warm July morning, just before dawn, the message arrived. *Big Baby Boy. Mother and child both doing well.* The General sighed, both with relief and in nagging fear. The "Big Baby Boy" was the Bomb; it had worked as planned with no surprises. "And child" meant that Major Lyles's mission, operated from a specially-prepared bunker directly below the detonation tower, had successfully winked out of existence. "Doing well" meant that the Major's sealed time chamber had popped back into existence, as planned, three hundred miles away from the Trinity test site. *A hell of a way to travel to Los Alamos from White Sands!* Sammons thought. *And still alive after a successful visit through time!*

Sammons stared at the terse statements, trying to absorb their impact. Had so much potential disaster ever

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been contained in so few words. *Maybe E = MC squared?* He gave orders to the Teletype operator to have Major Lyles flown directly to Washington immediately.

The next day, Major William Lyles met with General Sammons. "How'd it go, Major? What did you see up there in the future?" He smiled uncertainly. *What does one say to the first time traveler?* "Er, exactly when did you go?"

The Major, sharp in his dress uniform and showing no stress from his quick trip into the future, replied in a crisp military tone. "Sir, the atom boys can't tell exactly where I landed. Or, *when*, I should say. It was somewhere in Indiana or Illinois, I believe. I'm not sure of the year, but I think it was in the 1980s!" The General watched the junior officer carefully. *Not a smile, not any emotion at all. Good officer!*

"So, what happened?"

"Sir, I felt a big thump, then blacked out. Five minutes after the blast the mechanical timer rang the alarm bell and I woke up and opened the door as per orders, and took a look around. I was in a cornfield in the Midwest." He frowned. "I had hoped to land in or near a big city, but it didn't happen that way. Guess the atom boys couldn't calculate the trajectory just right. Anyway, I knew I only had about half an hour, so I ran to the nearest farmhouse. There was an old couple inside."

"What were they doing?"

"Watching a kind of radio with pictures," the Major said, a puzzled look on his face. "What *Popular Mechanics* calls 'television,' I suppose."

The General smiled broadly, relieved. "So it *was* the future!"

The Major didn't return the smile. "Yes, sir, I knew it was the future. You should have seen the—" he stumbled, biting his lower lip.

"The what, son? What did you see?" The older man was worried at this first display of emotion.

"The cars, sir. The cars! When I ran up to the house, I saw a pickup truck in the front. It was—it was—a Jap truck, sir! The name *Nissan*—a *Jap* truck!" His eyes watered. "I couldn't believe it, so I looked at a little rusting car on blocks in the back yard. It was—" He exhaled a breath, stood up and pounded his fist into a big palm. "A *German* car, sir. A Goddamned, rusting, beetle-shaped German car. A '*Volkswagen*'! I've seen pictures of it—Hitler's own design!"

The General paled. "Are you sure? But—" he saw more panic in the junior officer's face. "What else was there, boy? Damn it, tell me everything you saw!"

The soldier went calm again, controlling his responses. "Sir, the tractor was a Jap tractor—'*Mitsubishi*.' Today, they make the damned Jap Zeroes, Sir! In the future, they make tractors for American farmers!

"Well, Sir, I calmed down and then I went to the front door and knocked, and an old lady let me in. I told her my car was broken down and I needed to call my base. She seemed friendly enough, but I couldn't use the telephone. It had push buttons, not a finger dial, and anyhow, I didn't know where to call. And Sir, it said '*Hitachi*' on the front, that's a Jap name! You know that only Western Electric makes phones in the United States!

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"Then I saw a picture of a soldier on the wall and asked her who that was. She broke down and cried, sir. It was her son. He'd been killed in Korea, twenty-five years before!" The officer glared at his General. "Sir, we haven't even fought in Korea, yet. The damned Japs must have counterattacked there!" The General sat impassively, mentally formulating his advice to his Commander-in-Chief.

"And sir, when I met the old man, he was watching a picture show, I mean, the television, about us fighting in Viet Nam! That's *Indo-China,* sir! I asked him how long the war had been over and he said ten years. When I asked him what year that was, he told me sometime in the '70s!

"I mean, Sir, thirty years from now, we're still fighting Japs in Indo-China? There's Jap and Nazi cars and trucks and tractors and telephones in the Midwest? We must have lost sir! We *lost!*"

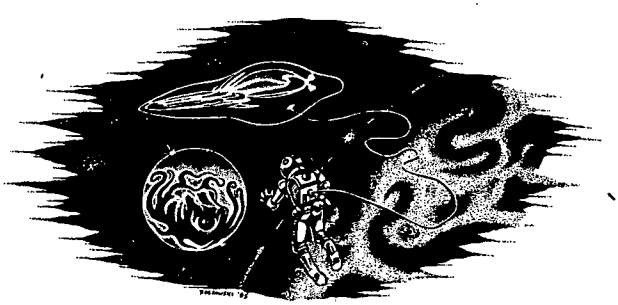
"But those people, they were Americans, right? Didn't they tell you about the war?"

"Sir, when I asked the old man about the war, he said he was tired of all of that war stuff. He pointed at the 'television'. There was an advertisement for Japan Air Lines, sir, telling how wonderful Japan was. The old guy told me, 'Boy, them Japs have ruined our factories and are taking over our farms. Them Asian gooks kicked our asses real bad in Viet Nam. Who do you think won? And where the holy hell you been all your life? What kind of Army are you in?'

"He eyed me sort of funny and went over to his telephone. Well, I ran out of the place, back to my chamber and waited for the recall procedure to start. I blacked out again. I came to back in Los Alamos, just a few miles from the predicted reclaim area. Then I flew here. That's all."

The General dismissed the Major and made straight to the teletype. *Japs taking over America! Nazi cars and Jap tractors and airplanes all over the world! We'll just see about that!* he thought. He peeked in at Truman's desk and read the desk sign.

"The Buck Stops Here," indeed. That buck is worth a lot more when you know what the future could be, when you know exactly how to invest it! He smiled with grim determination as he strode toward the Teletype operator with his recommendation in hand. ■



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I thought everyone'd forgotten the Boys from Stormville. Until *you* showed up, with your pile of clippings, and your goddamned youthful curiousity . . . it isn't easy to forget about something like that; it's nice to have someone to tell about it. Someone a bit special . . .

I was one of the first to report the thing, you know. Didn't have that tidbit in your file, did you? I felt like a fool, too, when those cops laughed me off the phone—that was way before the papers had started to headline the "mysterious boomerang UFO," and I was the only call they'd had around here.

I'm also the only one left who knows the truth: all that press about hotshot pilots in Cessnas faking UFO's over Ellenville wasn't anything like the whole story.

It wasn't over Ellenville, either, at least not when I first saw it; it was cruising big and slow and silent over Nyack, limping up the river. That was during the summer of the bad drought—1978 or 1979, I think—and I was out driving one night trying to get some air. I should have been able to hear engines—the windows were wide open and I killed the motor when I pulled over—but all I heard was the whine of trucks and cars along 9W. I was hanging out with a lot of pilots even then, so I'd learned to tell how high the cloud cover was just by looking up; this thing was only about fifteen hundred feet, not high enough to be that quiet.

Now I don't claim to know how big a football field would look if it were flying over Nyack at that height, but I'm pretty sure what I saw was bigger by several orders of magnitude. Shaped like a huge boomerang with white lights around the edge enclosing nothing—total, starless blackness—and absolutely silent. I watched it till it disappeared, slowly, behind the Hook—Hook Mountain—and then went straight home to call the police.

Like I said, they just laughed at me. And I didn't hear anything more about it for a while, till I guess some smart reporter managed to come up with a story for the papers . . . but it wasn't the real one, and I knew it.

I hadn't forgotten about the boomerang when a friend of mine who lives upstate—Grahamsville, it was—wrote me about it. Whatever he'd seen sounded a whole lot like the craft I spotted over Nyack, except that it was coming closer, and hovering, and taking off straight up. Silently. He told me the local sheriff had put the blame on some pranksters from Stormville Airport, and closed the book; *he* wanted to know more. So did I. Like I said, I knew a little about planes, even then, and it didn't sound to me like the kind of maneuver a Cessna could handle. I still remembered the way the cops treated me, too. It rankled.

But it took a while to get any further. And it lost me my job—no, I *wasn't* always a backwater flight instructor, wiseass. I got *that* idea after three months of poker-faced pilots in plaid jackets and hats with ear flaps telling me that, sure, they were doing impossible things with small planes but they wanted to keep it quiet. I finally figured out that I needed some first-hand education, and I started to take a few lessons. I got pretty well hooked on flying.

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And the ride. I guess it was really the ride that did it.

All the time I was hanging out at Stormville, trying to worm the real story out of somebody, there was only one guy who treated me like a person, who actually *talked* to me. He wasn't tall—a little below average height, in fact—but it hadn't made him belligerent like it does some guys, just intense. He was wiry; even his hair, a black ponytail with touches of grey, was wiry and wild. The first thing I'd noticed, though, was his eyes; they were almost black, and he had a way of drawing his thick dark eyebrows down and looking at you like he knew *exactly* what you wanted, and figured he could probably get it for you if the price was right. Anything for a challenge, and the thrill of flying. He was an ace pilot, and a good instructor—I watched him fly a lot, and I heard stories about some of his stunts. The other pilots up there might not have liked him, but they damned sure respected him.

I actually had the idea, for a while, that if anyone really *was* doing the kind of flying the newspapers kept talking about, like lights-out gliding in formation, he'd turn out to be the mastermind. So I stuck to him like glue, except when he told me to scram, and then I just watched from a safe distance. He did do a lot of night flying—they all did—but then, there were plenty of explanations for that which had nothing to do with UFO's.

And he never acted like he had anything to hide. I mean, he even let me in on the gas-tank modifications he'd made so he could fly non-stop from Jamaica when he had to. He didn't give me the feeling, the way the other pilots up there did, that they were just repeating something someone told them to say—over and over. *Nobody* told this guy what to say. He just didn't *say* much about the UFO's, was all. But you could tell it bothered him to hear about them, and one day when one of the other guys had really ticked him off he offered to take me up to see it. That night.

This guy—Wheeler, his name was —didn't do the usual methodical run-up and checklist at the runway approach. That should have worried me, but it didn't; when Wheeler got into the pilot's seat, the whole plane seemed to wrap around him like he was part of it, and I got the feeling there was an understanding between him and his plane that made those little details meaningless. Since there wasn't a tower to clear takeoff with, and no traffic—we heard some squawking from over Newburgh, I think, but nothing nearer—he just checked the windsock and taxied out.

We were off the ground before we hit the halfway mark, and it was a short runway. Wheeler hadn't said a word, besides "get in," till we were banking out over the trees. Then he started to talk.

"Listen, Mike. I know those jerks have been feeding you one hell of a long line about their stunts, even if they're pretending not to want to talk about it. But there isn't one of them who could really do the things people've been seeing lately. Not even me. There used to be someone around who could've . . ." he trailed off.

I started to say something about his modesty but he shsshed me quick—still

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scanning the instruments, he flicked off the landing lights and continued quietly. "Maybe nobody else cares to remember Laney, maybe by keeping quiet they feel like they're doing their Duties as Citizens, and maybe *that* helps them sleep at night, but I've had enough of this garbage and I don't appreciate people trying to tell me who I can and can't talk to, and about what." His voice was a mean monotone, and by the dim red interior lights his profile looked pretty tense.

"So there *is* something else going on up here!" I'd figured that out by then, but I wanted to make sure Wheeler didn't cool down too quick and get sensible, so I acted dumb. I knew it would irritate him.

"Of course there is, pea-brain. Just like Laney told me when he took me up here three years ago; there sure as hell still is. We're going to see an example pretty soon, so hold on." We banked again, slipped—I felt my stomach hanging somewhere up to the left of my head, and kept swallowing till it got back where it belonged and we leveled out over a long valley. The moon had come up—the ground picked up a little detail, trees and low hills. I knew there was some water, because I caught the moon's reflection twice, but there was no other light coming from below.

"Hey," Wheeler said, "stop looking at the ground. No wonder you can't figure it out—you're *still* looking in the wrong place."

"Sorry." I raised my head and looked out through the scratched plastic of the windshield, seeing nothing but blurred stars and a few streaks of cloud, or smog, way off to the south. We cruised along for a while, the engine droning, the wings cutting through smooth air, till I started to feel like we weren't even moving, just shaking in place.

At first I thought the vibration was getting to me when one cluster of stars suddenly seemed to be shifting—then the lights changed color and I knew they weren't stars. Wheeler pointed, and began a wide turn to bring us parallel to the thing. Sometime during the turn I realized I was terrified.

Wheeler must have seen it in my face. "Relax," he laughed, "I've been studying this baby for months, ever since I figured out its holding pattern. It'll never even notice us." And he proceeded to shut off all the lights, and every damned instrument in the cockpit.

Some kind of machismo kept me from screaming. I even managed to unlock my fingers before they ripped the vinyl armrest from its bracket. And finally admitted to myself that it seemed to be true—we were pacing a black boomerang that had to be about five times the size of a 747, with no indication that it knew we existed. No death rays, no spotlights . . . I leaned back in my seat and looked over at Wheeler.

"This is it? So what *is* it?" All I could see inside the rim of lights—some white, and some flashing colors—was flat, empty blackness. I had expected maybe a glint of metal, rivets, or an "unearthly" sheen, but instead it seemed like a perfect black-body radiator. The only motor I could hear was our own engine, and the air in the cabin felt strange when we got near the thing—tingly, sort of. Like there was a whole lot of loose electricity nearby.

Wheeler laughed again. "Yeah, this

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is it, all right. You think you're ready for the rest?"

"I'm here, aren't I?" I was getting impatient—he was positively enjoying himself. "So? Let's hear it."

"I'll do better than that, I'll *show* you. And don't worry, I'm not going to get carried away like Laney did. Hell, I'm not that crazy! Just remember; hold on, and keep quiet."

Before I could react—god knows what I could've done, anyway—we were up over the lights and diving into the middle of the blackness.

I guess I'll never know if he planned what happened next. I didn't get a chance to ask him, because right away things started to go haywire. It felt like we were spinning, and I could hear whispered curses as Wheeler fought with the stick and the flaps. He kept saying "let go, you crazy little buggers, let go," under his breath.

The moon was gone; I couldn't see six inches in front of my face. Figuring I was about to die anyway, a strange calm came over me . . . all I wanted, right then, was a glimpse of whatever was taking us down. I pressed my nose to the cold side window and peered out, into the leering face of a gargoyle. And then, so help me, I *did* scream.

"Shut the *hell* up!" Wheeler took his right hand off the stick long enough to bash me in the shoulder, and hissed "you're only going to make it worse. They don't like noise."

I shut up.

After a few seconds the spinning seemed to be slowing down, and I tried a whisper. "*Who* don't like noise?"

"The Boys," he answered shortly, still concentrating on getting control of the Cessna. I thought it was probably better not to bother him any more, and put my nose back to the window. Squinting hard, I made out three, maybe four of "the Boys"; not gargoyles, exactly, but like they gave the stonecarvers their ideas. Beyond them, maybe even *through* them, there were some foggy mechanical-looking structures that gave off little bursts of white lightning now and again. For some reason the song "Riders on the Storm," by The Doors, started playing in my head.

"Wheeler," I whispered—the engine had stopped, I noticed belatedly — "Where *are* we? Who are those guys?"

"The way Laney told it, they're just hallucinations, something your mind makes up when it can't cope with the nothingness. He said the reason we both see pretty much the same thing has to do with the electrical field. But I kind of like to think of them as the crew of this thing, Mike—this is one mother of a big craft." I heard admiration, almost longing, in his voice. "And then there's the thunder, wind, rain—all that stuff. Laney called it something like 'field effects', but you know me, I don't believe anything I can't see or feel. The way I look at it, these guys are the manpower."

I didn't bother to say I thought the "man" part was slightly inaccurate. "What does this thing have to do with the weather, Wheeler? I mean, all the stories, the sightings; I've never heard of any connection with weather patterns. Just lights, impossible maneuvers, eerie silence . . ." I'd decided by then that he was probably crazy, but what did that make me?

"Well, yeah, you're half right there.

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But it wasn't always like that," he said. "Laney managed to get things under control for a while, and then something went wrong. Probably those goddamned government meddlers—they had their own ideas about what to use the boomerang for. Anyway, the way I figure it, there's no goddamn pilot now. And these monkeys don't know what they're doing; they're not even real. Hell, they don't even know enough to shut off the landing lights at altitude!"

"And now the government bozos can hardly cope with keeping the whole mess quiet, for chrissakes. *They'd* rather be using this thing to spy on the Russians, if they had a pilot who didn't go soft at the sight of our friends out there. Laney used to laugh about that—something about structured minds and forced hallucinations not being compatible. But I guess he's not laughing any more, and all Uncle Sam can think of to do is pay those sorry excuses for pilots to confuse the issue by flying half-assed imitations of this thing . . . meanwhile more people are starving in Ethiopia, snow is falling in Dallas, drought in New York. Typical government mentality!" He was real worked up, and the ends of his hair were kind of crackling. "Somebody's got to fly the thing, dammit!"

Wheeler paused for a second, checked the gauges, and took a few deep breaths. "That's why I have to do this," he said, unbuckling his safety belt. "You can handle her, can't you? The runway lights are on—just tell 'em Wheeler sent you. And Laney."

I took the controls and held her pretty steady, too, while he squeezed out onto the strut. I was too surprised to do anything else. But then Wheeler started trying to shout some last words through the crack of the door, over the whistling air, and the Boys got irate again; the plane started to rock and spin at the same time, and I never got a chance to find out what he was trying to tell me about the ailerons because my head hit the windshield.

When I came to, there were pieces of the Cessna all around me in the shallow water. It wasn't a cold night, and by the time I dragged myself out onto the mud there were truck lights approaching. A farmer from the next valley'd seen the crash—he rushed right over, thinking it was the UFO. I guess he was disappointed; right then, I didn't much care.

He radioed in to the sheriff, and wrapped me in a blanket. I kept trying to tell him we should be looking for Wheeler, and he kept saying he didn't see much point in it till they came with some lights—that went on about an hour. Then there were troopers, and the sheriff, and some more locals, and it seemed like the whole valley was lit up but there wasn't a trace of Wheeler anywhere.

The guy from the National Transportation Safety Board came out the next day with some sharp-faced young assistant while they were dragging the pond. He asked me a lot of questions. I'd already told the sheriff about being inside the UFO, but I got the idea that if the NTSB investigator hadn't been so keen to wrap up his work they would have taken me straight to the nuthouse, or somewhere else, so I downplayed that angle. Like I'd had a shock, and I was coming to my senses.

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I kept hearing Wheeler's voice, saying "Somebody's got to fly this thing." I knew by then that they weren't going to find him, and I figured it was up to me to stay away from the government types for long enough to make sure his scheme was working. So I just told the investigator about the take-off, and said I was having my first night flying lesson and I guessed I'd blown it somehow. I left out the gargoyles, too.

It took me a while to convince the government guys that I didn't know anything, but I guess the sheriff felt sorry for me or something, because he never mentioned the UFO. It *was* kind of funny trying to fool the FBI types without letting on that I knew what they were looking for, and them asking these roundabout questions so I wouldn't figure it out if I didn't already know. I don't think they were amused, but finally they gave up. The official finding was that Wheeler was negligent in not doing a complete run-up, which would have told him his pressure was low. They say the engine blew; that I didn't have the skill to fly under those conditions, so I'd gone into a spin instead of gliding to a forced landing. I was lucky, they said, to be alive. They didn't even take away my pilot's license, just set my training back a few months. I finally made instructor, and I've been at it ever since. Didn't think I'd ever want to do anything else.

Your Aunt Sue was one of my first students, after I got certified. She had your looks, back then, dark and wild. I was trying hard to get to know her during lessons, but it wasn't till I signed the paperwork for her license that I finally put together what Wheeler'd been telling me about Laney and the "UFO" with the name on the paper: Susan Laney. She was too young to have been his wife, so I guessed Laney was her father . . . *Dr.* Laney, she told me when I asked her; "the late, eccentric Dr. Ferris Laney, inventor extraordinaire."

You probably know more about that part of the story than I do, being in the family—marriage doesn't count in things like this. It took *me* months to get Sue talking about her father's work, even after the wedding; she never did tell me everything about his disappearance. I had to piece all that together from little things she let slip, and what I remembered of that last crazy conversation with Wheeler. So feel free to correct me anywhere I go wrong, but keep your voice down—we're getting close. See those blue lights?

What it comes down to, anyway, is that your grandfather was a pretty ingenious guy. He figured that since humans and their technology had done such a number on the world—the whole global environment—it was our responsibility, or his, to start fixing it up again. So he invented the boomerang.

Unfortunately, besides being a good way to influence weather patterns, it's silent and pretty near invisible when the lights are off. That got the feds real greedy. Greedy and nervous. Your grandfather was a little naive at first—he thought they'd want to help the whole world, and not just our corner of it. But when they tried to take it away from him he woke up quick, and did about the only thing he could; destroyed the plans and hijacked the boomerang.

'Course, one drawback seems to be

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that there's no way to dismount, so to speak . . . and the operating life of the pilot seems to be pretty short, though it *is* getting longer—Dr. Laney only lasted for about three years, but Wheeler's been up there for a good ten already. Relax . . . they're just hallucinations. Ugly little buggers, aren't they?

I still have no idea what makes it work. But I know it does; I've followed the improvements since Wheeler took over, and I've gone through the weather data from the time of Dr. Laney's disappearance till then. It looks like we're coming into another bad spell, though, and I'm very much afraid that old Wheeler's no longer at the helm.

Hey, don't worry, I'm not crazy. Wheeler, yeah, and Laney too, for all I know—but not me. See, I figure there's a set of plans in the cockpit, and I've been reading your grandfather's books. I think there may be a way to make radio contact, maybe even land the thing.

Meanwhile, *somebody's* got to fly it . . . don't look at me like that. I for one am not ready to let the whole world go to hell for lack of a few good pilots. You can handle a Cessna, can't you? Here's the stick. Tell your Aunt Sue to keep the channel open. And listen, kid, whatever happens, *keep flying*—sorry, didn't mean to raise my voice—we may need you in a few years. ■

● Competition for food is always a competition for space, and that applies whether the animals are foragers or growers. In this country there are people who think such a concept does not apply to humans. In China, some feel, only the suicidal would not apply the concept to humans. Perhaps if someone from biology could explain to humans in this country the need for birth control, people would willingly limit the size of their families. No one seems to know the language. Perhaps there is no language. But if, in this matter, nature were called upon to arbitrate, everyone would soon understand the price. For when nature calls its creatures to account it has but a single goal, balance. In securing that balance it often enough extracts unconditional surrender.

Robert Holland

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a calendar of analog upcoming events

25-28 January
General meeting of the American Physical Society at Crystal City, Va. Info: A.P.S., 335 East 45th Street, New York, NY 10017.

29-31 January
CHIMERACON V (North Carolina SF conference) at University of North Carolina, Chapel Hill, N.C. Guest of Honor—Nancy Springer. Events include costume workshop and contest. Registration—$12.50 in advance; $6/day, $11/2 days, $15/3 days at the door. Info: ChimeraCon V, 15-A University Gardens, Chapel Hill NC 27514 (919) 933-3003.

29-31 January
BOSKONE XXV (New England Regional SF conference) at Sheraton Tara and Springfield Marriott, Springfield, Mass. Guest of Honor—Greg Bear, Official Artist—David Mattingly, Special Guest—Ellen Asher. Registration—$25 in advance, $40 at the door. Note: attendance is limited to 2,000 by facility space; there is a possibility that no memberships will be generally available at the door. Info: Boskone XXV, Box G. MIT Branch PO, Cambridge MA 02139.

5-7 February
OMNICON VIII (Mixed-media convention) at Oceanside Holiday Inn, Fort Lauderdale, Fla. Info: Omnicon, Box 161642, Miami FL 33116. (305) 253-7270.

12-14 February
CONTINUITY (Alabama SF conference) at Holiday Inn Medical Center South, Birmingham, Ala. Guest of Honor—Jo Clayton, Artist Guests of Honor—Val & Ron Lindahn, TM—Sharon Webb. Registration—$20 until 1 February 1988, then $25. Info: Greater Birmingham SF&F Association, 5304 Dixieland Road, Birmingham AL 35210.

12-14 February
ECLECTICON 2 (Sacramento area SF conference) at Beverly Garland Hotel, Sacramento, Calif. Registration—$20 until 15 January 1988, $25 at the door. Info: Eclecticon 2, 3630 King's Way, #33, Sacramento CA 95821.

1-5 September 1988
NOLACON II (46th World Science Fiction Convention) at Sheraton Hotel & Towers, Marriott Hotel, Rivergate Convention Center, New Orleans, La. Guest of Honor—Donald A. Wollheim, Fan Guest of Honor—Roger Sims, TM—Mike Resnick. Registration—Attending $60 until 31 December 1987, $70 to 10 July 1988. Supporting—$30. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo awards and the John W. Campbell Award for Best New Writer. Info: Nolacon II, 921 Canal Street #831, New Orleans LA 70112 (504) 525-6008.

19-21 February
WISCON 12 (Wisconsin SF conference) at Holiday Inn #2, Madison, Wisc. Guests of Honor—R.A. MacAvoy and George R.R. Martin, Special Guest—Stu Shiffman. Registration—$15 until 29 January 1988, $20 at the door. Info: SF3, Box 1624, Madison WI 53701. (608) 251-6226 (days).

26-28 February
CONTEMPLATION (Midwest SF Conference) at Ramada Inn of Columbia, Mo. Guests of Honor—Jerry & Roberta Pournelle and Larry Niven, Artist Guest of Honor—J.R. Daniels, Fan Guest of Honor—Keith Berdak. Registration—$14. Info: Contemplation, Box 7242, Columbia MO 65205.

—Anthony Lewis

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There are things man wasn't meant to know—
or at least *customers* weren't!

DOC'S LEGACY

Christopher Anvil

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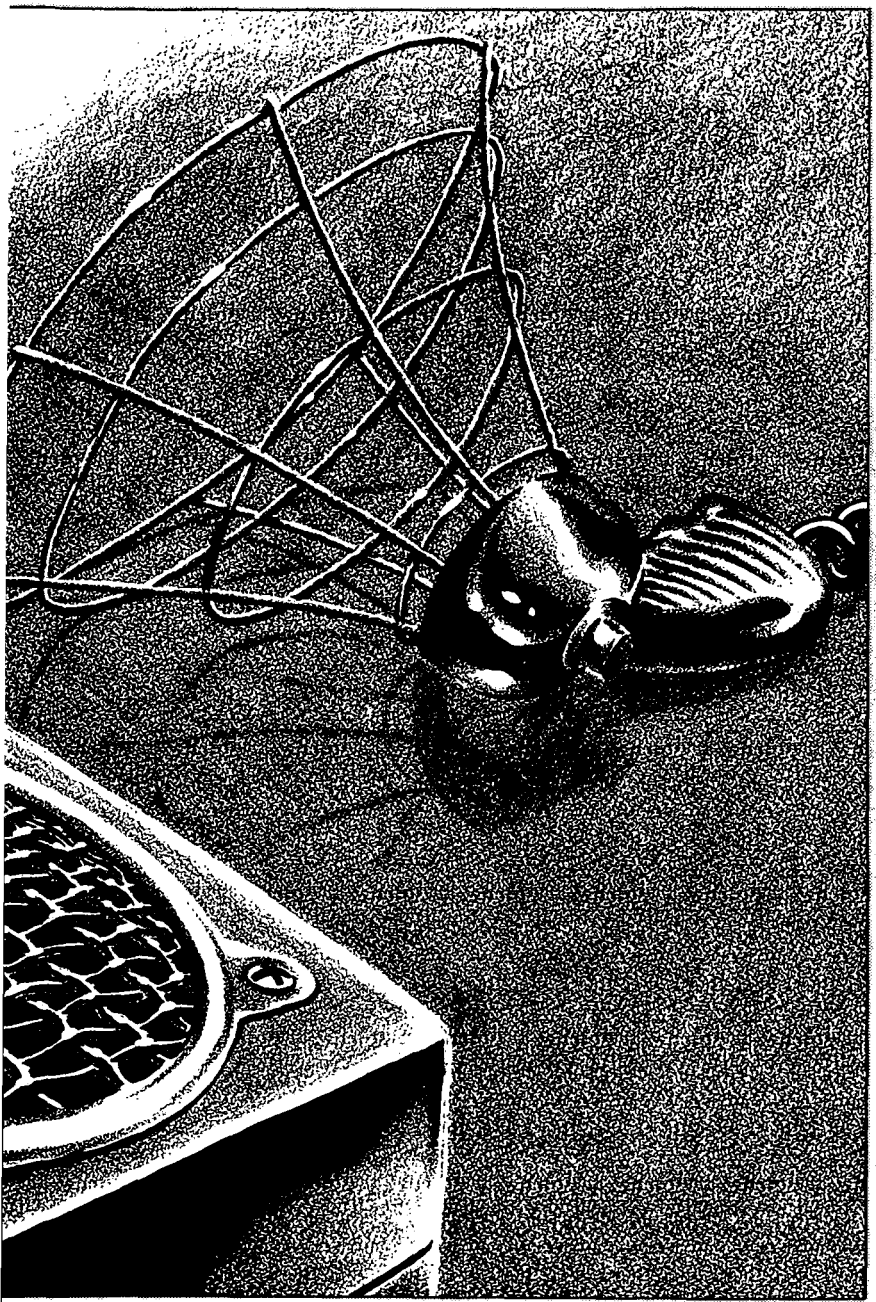

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Felix N. Muir, A.S., forgot the beautiful summer morning outside as he glanced from James Allen, Director of Research, to the gadget that Allen with studied casualness was unloading onto Muir's desk.

At first sight, the device looked like a pocket calculator. But where the display should be, there was a meter; and where there should be rows of push buttons, there were just two grey buttons, with an additional black button around on the side. Connected by a thick electric cord was a small megaphone-shaped apparatus of slender copper rod.

As Muir came to his feet, Allen gave a genial nod, then reached back for the knob of the hall door. Plainly enough, the Director of Research was about to toss Muir a few words of instruction, and depart.

Muir, though still new at this job, moved fast, and pulled over a chair.

"Have a seat, Dr. Allen."

"Oh," said Allen, "I don't have time—"

"And what is this?"

Allen favored Muir with a friendly man-to-man smile.

"It's just a little—you know, a—ah—toy—of Doc's. I want you to—"

Muir blinked. In this company, "Doc" meant just one person.

"Toy? Of Dr. Griswell?"

Allen got his hand on the knob. "Yes. Now, I want you—"

The words were out before Muir had time to think: "If this belonged to Dr. Griswell, I don't touch it without an explanation."

Allen's face lost its friendly smile. "See here, Muir—"

Muir's thoughts caught up with his reactions, and he added persuasively, "Suppose someone gave you a bottle of a yellowish oily liquid, Dr. Allen? Wouldn't you be uneasy if it turned out to be nitroglycerine?"

"Glyceryl trinitrate. Well, that is a—h'm—mistaken comparison." Allen hesitated, cast a penetrating glance at Muir, and added, "But I see your point." He pulled over the chair, and uneasily moved the little megaphone-shaped device so it aimed elsewhere than at him. "You're comparatively new here, Muir. What do you know about Doc Griswell?"

"Well—He invented the asterator."

"Do you understand the asterator?"

"As far as the mechanism is concerned, I don't remotely understand it. As for the effect, I know what's common knowledge."

"Namely?"

"The asterator has a number of reaction chambers. Each chamber emits a narrow beam. Just as glass is transparent to light, ordinary matter is transparent to the asterator beam. The beams can focus on a common target. In a target containing unstable nuclei, the nuclei decompose."

"The significance of this—?"

"Nuclear weapons and reactors contain a lot of unstable nuclei. If an asterator focuses on them, the weapon or reactor blows up."

Allen nodded. "And the political effect?"

"Not long ago, the major powers had arsenals of nuclear weapons. Then Doc Griswell invented the asterator. Suddenly a nuclear weapon was more dangerous to its possessor than to anyone else. The result was rapid voluntary nu-

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clear disarmament, which is still going on."

"And Dr. Griswell?"

"Dr. Griswell's car crashed into a stone wall before the facts came out."

Allen nodded soberly. "The asterator was a work of extraordinary genius, or a remarkable accidental discovery—Or, perhaps, both. But for Doc Griswell it was a tragedy. Doc wanted safe, trouble-free nuclear power. The wave of accidents, when the asterator was first tested, was completely unexpected. And, of course, no one realized at first that the asterator was the cause. Doc evidently blamed himself, and—" Allen's voice briefly choked.

Muir said sympathetically, "Well—They said it was suicide. But who knows? Where his car went off the road, there's a sharp curve. If he was distracted—"

"You're familiar with the spot?"

"I drove out there one night. There are big evergreens that cast dense shadows in the moonlight. With the wall and the curve hidden in the shadows, that spot looks like two or three perfectly harmless places on the road."

"But Doc's headlights—"

"On high beam, on the rise just before the curve, the lights lift up off the road. The danger isn't clear."

Allen stared across the room. "Beasley and I blamed ourselves, and felt guilty. You see, we worked very closely with Doc, but he didn't trust us enough to take us into his confidence when things went wrong."

"That's assuming he deliberately drove into that wall. But suppose, as he neared the curve, that a thought occurred to him about the asterator? All it takes there is night, a fast car, the moon in a part of the sky to cast the right shadows, and one second's distraction. He knew the road; but he may not have had that combination before."

Allen sat silent for a moment, then cleared his throat. "Gloria Griswell brought the touchstone in yesterday."

Muir looked blank.

Allen said, "Gloria is Doc's widow. The device I just put on your desk is what Doc called his 'touchstone.' "

Muir looked at the meter, push buttons, and electric cord with its small cone-shaped apparatus. "A 'touchstone' is used to test whether something is genuine. What kind of—"

"Exactly the sort of question I'd like you to investigate, Muir."

Muir cast him a fishy look. "And Mrs. Griswell?"

"What about her?"

"Dr. Griswell died almost two years ago, didn't he? Why did his widow only bring this in yesterday?"

"Roughly two years ago. Yes. I was surprised to see her."

"Why did she bring it in now?"

"She wanted it out of the house."

"Why, after having it around that long, did she only now want it out of the house?"

Allen looked at Muir approvingly. "You're quick, Muir. You really should try for a higher degree."

"Not with my temperament. Why did Mrs. Griswell suddenly want to get rid of this device?"

"What does your temperament have to do with it?"

"There are times when I think I'm leaning over backward, and everyone else thinks I'm spoiling for a fight. It

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doesn't go down well against an academic background."

"With a little tact, people would soon realize that they were mistaken."

Muir looked faintly embarrassed. "The trouble is, they're not always mistaken."

"Ah," said Allen, smiling, "that's different."

"Why did Mrs. Griswell suddenly want this device out of the house?"

"Her fiancé objected to it."

"Fiancé?"

"Well, she—you see, she—" Allen paused, then tried again. "She intends to remarry, and, of course, no one can criticize her for that. She's certainly waited long enough to show respect for Doc's memory. Especially as things are these days. And no one could ask—"

Muir squinted as if trying to get Allen back into focus. "I had the impression Dr. Griswell was quite elderly when he died."

"Yes. He was an elder brother to us. He had not only an exceptional and vigorous originality, but a long experience in the field."

"How old is Gloria Griswell?"

"Oh, quite young. Everyone was stunned when she and Doc got married. Two people more completely different . . . But they understood each other, and got along wonderfully."

"You're saying Gloria Griswell is young, is getting remarried, and her boob of a fiancé doesn't want this 'touchstone' in the house?"

Allen stared at Muir, then nodded.

Muir said shortly, "Did she just let him into her bedroom, or what?"

Allen's head jerked as if he had been slapped. He began to speak angrily, then stopped with an odd listening look. "You reason that she would probably have kept the touchstone near her as a kind of memento? And that her fiancé would only have come in contact with it when he—er—experienced a—ah—considerable degree of intimacy?"

"If this fiancé didn't object before, why now? Something must have changed."

"That reasoning does seem valid."

"What doesn't the cretin like about it?"

"How—"

Muir leaned across the desk. "You're holding something back, Dr. Allen. And incidentally, is he marrying her for money, or what?"

Allen stared at him. "Muir, you have a habit— Not that I object, of course—Doc used to do the same thing—"

"What?"

"You don't respond to what's said, you respond to what you deduce from what's said. And I fail to grasp your reasoning. For instance, you've referred to Gloria Griswell's fiancé as a 'boob,' a 'cretin'—"

"Isn't he?"

"Oh, most assuredly. A more conceited, theatrical, self-seeking . . . But the question is, how do you know? Have you met him?"

"No. And I'm not eager to."

"And now, you ask, is he marrying her for money? Where did you get that idea?"

"Don't you agree?"

"Of course I agree! Though, really, she's attractive enough. Beautiful, actually. But the question is, how do you now deduce, rightly or wrongly, that he's marrying her for money?"

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"What you said implied it."

"I didn't imply it. You inferred it. How?"

"There was something in what you said—"

"What?"

"H'm . . . I don't know . . . But now you're saying that there is some serious drawback—some reason a man wouldn't want to marry her. Even though she's beautiful."

Allen nodded wonderingly. "Exactly the kind of answer I used to get from Doc. That is, no answer at all, and very possibly a new deduction, equally unexplained."

"It's there in what you said."

"How?"

"Well—if there was no reason to think this fiancé naturally would not marry her, then how can you be sure he's marrying her for money? If she's young, rich, and beautiful, how do you know he's only thinking of the 'rich,' and not the 'young and beautiful'?" Muir paused, frowning. "And incidentally, why is she marrying him?"

Allen looked momentarily disoriented. "I don't know. But she's very vulnerable."

"A young rich widow?"

"It's worse than that. She admired Doc greatly. You could see the affection and the pride in her eyes. I'm afraid that her admiration for Doc led her to admire genius in general. Then, too—" He paused suddenly.

Muir was frowning at Allen. "You mean, she takes this fake for a genius?"

Allen sat back, staring at Muir. "Precisely. And—" He caught himself.

"And what?"

"Oh, nothing specific. We've gotten off the track. What I need done is to have the properties of this device very carefully investigated."

Muir looked at him skeptically. "You worked with Dr. Griswell. You must know the answers already."

"Well, but . . . You see, Beasley and I couldn't be sure . . . and . . . You could say Doc was much closer to Beasley . . . And of course to Gloria . . . Yes, I'm sure he explained to Gloria. —And then, his sense of humor. Was he serious, or . . . His scientific reputation could be badly damaged if . . . No. I can't do it. But . . ."

Muir nodded. "In short, whatever the thing does, there are theoretical objections. So you are tossing me the hot potato."

"Well, I—ah—" Allen smiled. "Yes. Precisely."

"At least we understand each other. Now, what if there should turn out to be some credit in it?"

" 'You do the work, you get the reward.' That was Doc's policy. But be careful, Muir. I doubt there is anything in this theoretically but trouble. And you have to remember, it's Doc's device. However, aside from all that, if it makes you rich and famous, well . . . just add a footnote that I put it on your desk."

Muir smiled. "It's a nice dream."

"Possibly more than that. I'd better mention what Doc said about it: 'If the human race survives the nuclear mess, the principle behind this may keep us out of the next hole.' He wouldn't have said that lightly."

"But you don't want to say anything more about it?"

"No."

"Where is Dr. Beasley now?"

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"As nearly as I can recall, he was going to take a long vacation as far from the lab as he could get. I think that would put him somewhere in the South Pacific. I'm afraid he's out of reach."

"I see. Well, if you should happen to remember anything about this device . . ."

Allen gave a sort of half-nod and half-shake of the head, along with an uninterpretable wave of the hand. He came to his feet, and reached for the doorknob. For an instant, he seemed about to say more. Then he smiled, and went out.

Muir sat for a moment looking at the closed door. Then he carefully picked up the device, turned it in his hands, and considered the black button on the side. Then he looked thoughtfully at the two grey buttons.

He sat frowning for a moment, then went to the back of the room, and bent at a large old-fashioned safe. He straightened up holding a scuffed attaché case, crumpled up a newspaper for padding, and carefully put the "touchstone" in the case. A few minutes later, he was in the sunlit parking lot, getting into a small beat-up blue car that sat in the shade of the building. Despite its appearance, the car started at once, and he pulled out onto the road.

If he remembered correctly, it should be seven or eight miles to the Griswell place.

Eli Kenzie, president of the company, stood at his office window, and watched the battered blue car glide swiftly out of the lot and down the road. He turned at a knock on a door that led, not to his outer office, but to a short hall giving access to a washroom, a small elevator, and the stairs down to his parking slot.

Kenzie unlatched the door, and Allen stepped in, looking bemused. "I gave Muir the touchstone. But it cost some information to get him to work on it."

Kenzie closed and locked the door.

"Why not just tell him to do it?"

"He wouldn't touch it without an explanation. He compared it to 'nitroglycerine.' "

"He did? Well, he's got a point. By the way, he just came out the north door carrying a briefcase, got in his car, and left in a streak."

"Already? Which way?"

"Away from the highway. Toward Doc's place."

"Then there's a good chance he went to ask Gloria about the touchstone."

Kenzie sat down on the edge of his desk. "I'm surprised he's so independent. From what you'd said, I'd gathered that his qualifications were few and far between."

Allen looked uncomfortable. "He has few formal qualifications; but he was on that list Doc made out, of individuals whose work he wanted followed. When we needed someone, I sent a query to everyone on the list. Muir was the only one still low enough on the totem pole to be interested."

"Which, by itself, suggests he's no hotshot."

"No hotshot at getting ahead in the world."

Kenzie shrugged. "Cream rises to the top."

"There are times when you want to check the bottom. Gold is pretty heavy."

"Name an instance."

"Well, Galileo wound up impris-

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oned. If I'm not mistaken, Archimedes was very unpopular for a while. First-rate minds have passed unrecognized simply because they didn't seek recognition, antagonized people, published in the wrong journal, or their methods just weren't in style."

"What's the explanation for Muir? He's old enough to be a lot further ahead."

"I don't know. But for just an instant, I would cheerfully have fired him myself."

Kenzie looked interested. "Why?"

"He told me flatly he wouldn't work on the touchstone without an explanation."

"He did, eh? He's lucky to have the job, and he's being paid for it. And if it weren't for Doc's interest, whatever the reason, he wouldn't have it."

"All that was in the back of my mind. It boiled down to: 'Who is he to use that tone?' "

"What did you do?"

"Before I got started, he explained his reasons."

"That took the edge off it?"

"Yes. And incidentally left the impression that he had just recently discovered tact, and was determined to give it a fair try."

Kenzie laughed. "That could explain quite a lot."

Allen nodded. "In some ways, Muir reminds me of Doc. He has Doc's trick of answering not what you say but what he deduces from what you say. I'm just wondering if he also has Doc's quirk of assuming anyone who misunderstands him does it on purpose. It made trouble enough with Doc, as you remember."

Kenzie winced. "Let's hope not. At any rate, he has the touchstone?"

"Right."

"Then, for now, that gets the impossible damned thing off our necks. There isn't another invention of Doc's lying around, is there?"

"Not that I know of. Anyway, one mess at a time."

"That leaves Gloria herself. Even if it isn't any of our business."

Allen said exasperatedly, "But what can we do?"

"Well, the touchstone's apparently on it's way back out there. That should confuse matters a little."

"I tried to argue with her yesterday. She thinks that bearded fake is a genius."

"Genius? That confidence artist!"

"But what can we—?"

"If it weren't for Doc, I'd say, forget it! A woman can fall in love with any slick conceited fraud."

"I don't think," said Allen, frowning, "that it's actually love."

"She's going to marry him, isn't she?"

"I think it's a sense of duty. Remember, she has some serious little problems."

Kenzie nodded moodily. "True enough." He walked around the desk and sat down in his chair. "If it's not love, then, at least, if she should fall in love with someone else—"

"With Gloria, who knows? She may even feel it's her duty to Doc. After all, she can't handle the situation alone. And, just incidentally, who but a confidence artist would stick around?"

Kenzie shook his head. "We shouldn't be spending our time on this. But, damn

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it, the company was built on Doc's ideas! We can't just toss his widow to the wolves!"

Allen said exasperatedly, "The fellow uses the situation to present himself in a favorable light. But you'd think even he would have his limits."

Kenzie sighed.

"Well, let's hope Muir makes some progress with the touchstone."

Muir slowed, rounded the remembered sharp turn, and soon was looking at Doc Griswell's colonial house set back in the shade of big maples. To the left of the house, a shiny black Cadillac was parked in the graveled drive. Muir pulled in behind it, got out, and closed the car door loudly. He stood still, to listen.

In the warm sunlight, there was a sigh of wind in the trees, and a buzz of insects—but no sound of people. Leaving his attaché case locked in the car, Muir followed a shaded walk of flat stones toward the front of the house. The only new sound was the whine of a passing mosquito that came back for a closer look.

Muir paused opposite the front door, heard no one inside, stayed a moment to settle with the mosquito, then followed the walk to the side of the house. From somewhere in back came sounds of an argument, then of running feet. Muir paused, to cough loudly.

A small boy burst around the rear corner of the house, sobbing, and raced along the walk toward the front.

Muir stepped aside. The boy stubbed his toe, tripped, and Muir, moving fast, caught him before he hit the stones.

The boy, sobbing desperately, threw his arms around Muir's neck.

Beside the rear corner of the house appeared a young auburn-haired woman who called angrily, "Marius!"

"No!" cried the boy, his face buried in Muir's shoulder.

Just behind the woman strode a man with a black mustache and beard, wearing a black suit, black shoes, a black cape lined in red, and carrying a black attaché case and a straight black cane with a shiny metal tip. He spotted Muir, and stepped in front of the woman, as if to shield her from contamination.

Muir grunted. "Now what? Count Dracula?"

The boy twisted around, looked at the black-caped figure, glanced at Muir's expression, and grinned. He murmured, "Mommy's would-be inamorata."

"Wrong gender."

"No, it's an insult."

After a moment glaring at Muir, the caped figure came striding up the walk, the metal tip of the cane striking the stones rhythmically.

The boy kept a tight grip around Muir's neck. "Watch out for the cane. He's tricky."

The approaching figure studied Muir with distaste. "And just what do you flatter yourself that you're doing here?"

"I'd like to talk to Mrs. Griswell."

"Mrs. Griswell isn't free to talk to you."

"I'll ask Mrs. Griswell, if you don't mind."

"I do mind. My name is Vandenpeer. You are asking to speak to the future Mrs. Vandenpeer. I refuse permission."

The boy said, "Mom won't marry you! I'll die if she marries you!"

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Down the walk, the woman put her hand to her forehead.

Muir said politely, "I appreciate your feelings, Mr. Van Damper, but I'll ask Mrs. Griswell herself."

"Vandenpeer." He pointed the cane at Muir, then flicked it toward the driveway.

"Get out."

Muir turned toward Gloria Griswell, as she wearily brushed back her hair, looked in faint puzzlement at Muir, and turned to approach. As Dr. Allen had told him, she was beautiful. Muir had seen beautiful women before, but this was the first time he found himself unable to look away. The sun, shining at intervals through the trees, lit her auburn hair with a warm glow, and Muir suddenly realized how much he liked auburn hair. Her movements, too, though slow and weary, were indescribably graceful.

Vandenpeer's voice pierced Muir's trance.

"Set that boy down and get out!"

Muir tore his gaze from Gloria Griswell. The boy tightened his armhold on Muir's neck. Muir said, "I came to ask Mrs. Griswell about something important—"

"Important to my fiancée or important to you?"

"I won't know until I've had a chance to speak to Mrs. Griswell."

"Then my advice is, get out. You aren't going to get a chance."

"I don't mean to be disagreeable," snarled Muir, "but I didn't ask your advice. And keep that stick out of my face."

Vandenpeer smiled contemptuously, and swung the cane so that he was holding it against his thighs, horizontally, apparently negligently, in widely spaced hands. He was holding it, Muir realized, in such a position that if he, Muir, were to step forward, Vandenpeer could hit him across the midsection with the end, and move on from there.

Muir tried to set the boy down. The boy clung tight. "No. He'll get you with the cane."

"Has he used that thing on you?"

"Not yet. He wants to marry Mommy first. Then he'll have the right. He'll call it 'good discipline.' He's already stolen my magic carpet. He calls that 'good psychology.' "

Muir turned to speak to Gloria Griswell. He looked at her, but immediately forgot what he was going to say.

Vandenpeer straightened menacingly.

From down near the corner of the house, there came a high-pitched scream, a sob, and the rapid patter of small feet.

Vandenpeer turned furiously. "I told you she'd get out, Gloria! You've got to put something over the top of her playpen!"

A small girl burst around the corner of the house, sobbing hysterically, "Mommy! Mommy! Don't leave me! I'm afraid!"

The boy leaned away from Muir's ear, to shout, "Watch the stones, Mom! I'd have broken my neck, but the man caught me!"

Vandenpeer cast the boy a venomous look.

The girl stumbled, and Gloria Griswell caught her, and the girl threw her arms around her mother's neck and sobbed. As her mother picked her up, she stopped crying to glare over her

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mother's shoulder at Vandenpeer; after a truly nasty look, she went back to sobbing hysterically.

It occurred to Muir that there was something here he didn't understand; but as he glanced at Gloria Griswell, the thought evaporated.

Vandenpeer stared at his fiancée's small daughter, shook his head, reached for a handkerchief, and mopped his brow.

Muir said in a polite voice, "I don't mean to intrude, Mr. Vandenpeer, but—"

Vandenpeer stared at him incredulously.

Muir went on, "but I'm curious about the boy's 'flying carpet.' Did you really take it?"

"By what right—"

"There!" cried the boy, "It's sticking out of his case!"

Muir noted an edge of worn blue cloth protruding from the attaché case. "It might be a good idea to just open up that case and show what you've got there."

"Oh, for—Why, you impudent pipsqueak! If you don't want to intrude, get out! Set the boy down, get back in your car, and go!"

The boy tightened his arm around Muir's neck. "He's got more right here than you have! All you do is threaten me and steal my things! Daddy gave me that magic carpet! You've got no right to it! Give it back to me!"

Gloria Griswell, holding her daughter, was looking with an unreadable expression at her son clinging tightly to Muir.

Muir said to Vandenpeer, "I don't claim it's any of my business. But since you are neither the boy's father nor his stepfather, whatever your intentions, it strikes me you have no right to his things. Suppose you just hand over what belongs to him, and I'll leave for now. But . . ."

The boy said, "He'd just take it back as soon as you left."

"But," said Muir, unaware that his manner suggested a gun turret turning toward a target, "unless Mrs. Griswell says no, I aim to be back later today, or tomorrow, or just as soon as she will speak *with* me."

Vandenpeer studied Muir alertly, then shrugged. "Get it over with now. Speak your piece, and get out."

"What I have to say," said Muir, looking at Gloria Griswell, and he was again struck dumb. After a stretch of time somewhere between a few seconds and eternity, he recovered enough to finish, "could only be said privately."

She looked back at him, and he didn't think to look away. Time drifted pleasantly past.

It dawned on Muir that the boy had dropped free, grabbed the attaché case, and was now yanking out what looked like a worn pale-blue blanket.

Vandenpeer, clearly surprised, made a grab at the boy, missed, and snarled, "You damned little sneak!"

Gloria Griswell looked around in astonishment.

Vandenpeer noted the look. "That blanket has to be gotten away from him, Gloria! He's dependent on it!"

Muir said, "What of it?"

Vandenpeer snarled, "Who spoke to you? What do you know about it? Are you a psychologist?"

"Are you?"

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The boy had returned to Muir, who absently picked him up, and then felt the blanket pressed hard against his fingers. Embedded in the cloth were what felt like fine wires.

Gloria Griswell said angrily, "I don't see why Marius can't keep his blanket!"

"We won't discuss it now."

"Oh, yes," she said, "we *will* discuss it now!"

"Not in front of outsiders."

"Will you stop telling me what to do! And how dare you call Marius a sneak!"

The little girl twisted around in Gloria Griswell's arms, and favored Vandenpeer with a sickeningly sweet smile. The face of the boy was invisible to Muir, but not to Vandenpeer, who looked jarred, and suddenly said, "Now I will leave!"

Muir said helpfully, "I'll move my car."

As they walked around to the front of the house, Vandenpeer cast a murderous look at the boy, then glanced curiously at Muir. "I hope, for your sake, that you know what you're getting into."

"Frankly, no. But if you feel that way, shouldn't you be glad to get out?"

Vandenpeer began to speak sharply, then scowled. "As a matter of fact, that is a damned good point. There's a limit to the price anything is worth!"

Muir got in his car, and backed onto the grass beside the drive. Out on the road, a car accelerated past, followed a moment later by another,

Vandenpeer started to back his car down the drive, then paused opposite Muir, and his window slid down. Vandenpeer raised his left hand, and peeled back a flesh-colored bandage. He said, man-to-man, "Watch out for Sally. She bites."

Muir blinked. "Thanks." He hesitated. "Careful on the way out. Some of those cars speed up going by."

Vandenpeer nodded. "They come fast." He backed out, and left with a roar.

Muir parked, and glanced sharply at the boy. "What did you do to yourself?"

"Rubbed spit on my face."

"Why?"

"It makes him sick. I almost made him throw up once."

Muir handed over his handkerchief. "*Does* Sally bite?"

Marius wiped off his face. "Well, she's just a girl. There isn't much she can do. But it helps. He can't suck around Mommy when he's in the emergency room."

"H'm." Muir got out, and started down the walk. The something here that he didn't grasp plainly related to Marius and little Sally. Could it just be Doc Griswell? Doc had been regarded as a genius, but a curmudgeonly genius capable of defying authority and standing opinion on its head. Possibly the children took after their father?

This train of thought was interrupted as Muir discovered he was again carrying the boy. They went to the corner of the house, saw no one, then, from inside, came a sound of quick footsteps. Muir turned toward the front door.

Gloria Griswell looked out. "Won't you come in, Mr.—"

Muir's pulse speeded up. "Muir," he said. "My first name, I'm afraid, is Felix." He started to let the boy down, but the boy declined to get down, so he

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went up the steps carrying him, and stepped through a hall into a large cool living room. The boy said, matter-of-factly, "You can't make anything good out of 'Marius,' either." He dropped to the floor, and looked at his mother. "I'll go watch Sally while you talk to Felix, Mom."

Gloria Griswell turned to stare after her son as he ran, clutching his blanket, out of the room. She turned back toward Muir, who now experienced the pleasant illusion that the room was far from anywhere else, with just the two of them there, alone. After basking in this illusion for a lengthy stretch of time, he recovered the use of his voice.

"I'm afraid I've interrupted your whole day. What I started out to ask about was one of Dr. Griswell's inventions."

She smiled, and time stopped again.

Muir finally recovered enough to glance at a clock on the mantle. "It's after one. I know you won't want to leave Sally and Marius, but I think there's a fast food place down the road. If you don't mind the menu, I could bring back something for lunch."

Before she could say anything, Marius stepped back into the room. "Mom, Dad's touchstone is gone. It was always in the hall cupboard, outside your door, and it isn't there now."

Muir said, "That's what I came about. Dr. Allen put it on my desk this morning, and I've brought it with me."

The boy, startled, looked at Muir.

Gloria Griswell shook her head. "My crimes are catching up with me." She looked back at her son. "I took it in to Dr. Allen, because I thought your father would want him to have it if we didn't. And I knew Van didn't want to see it again. You used it on his plans, remember?"

"Him," sneered the boy. He glanced at Muir. "He brought his plans for the house he was going to put up here after he tore this house down. You should have heard the touchstone."

Muir shook his head. "I don't know much about it. Dr. Allen wanted me to look into it, and I came out here to ask for advice."

Marius beamed. "I'll show you how it works. Or Mom can." He looked back at his mother. "But, Mom, I'm hungry, and Sally says she's hungry. Did I just hear Felix say he'd get us something to eat?"

"Just before you came in. But—"

"You better go with him, Mom. He might get lost." The boy glanced apologetically at Muir. "It can be kind of complicated."

Gloria Griswell looked hard at her son.

Muir nodded. "A good idea." He glanced at her. "But if you'd rather not leave them alone—"

Her voice had a somewhat strangled sound. "I think they can take care of themselves." She took another look at young Marius. "It should only take us a few minutes."

"If," said Marius, "you don't get lost. I want a double cheeseburger and a chocolate milkshake. Sally wants a hamburger and orange juice. We both want french fries. We could use a blueberry pie and an apple pie, and we'll fight that out after we've got them."

Muir dutifully repeated the order, led the way outside, and held the car door open.

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"Did you," she said, on the way down the road, "have the impression of being manipulated?"

He laughed. "How could you think it?"

"Look there."

Straight ahead was the local franchise of a worldwide fast-food chain. So far, they had passed no intersection or side road.

She said, "Did you need my help to get here?"

"Of course. I could have turned the wrong way, coming out the drive."

"For weeks, nearly every time I've tried to go out, something would happen, and usually Marius or Sally was responsible. Now they all but push me out."

"Sally, too?"

"Sally, too. Though he's the ringleader."

They stopped in the line of cars at the drive-in. He turned to her, and she looked back and smiled. The car ahead moved on. The car behind gave a blast of the horn.

A few minutes later, they were back on the road, with their order in several large bags. As they got out of the car, Marius ran out, studied their expressions anxiously, then looked relieved. He took the bags, methodically selected his share and Sally's, and said, "I cleared off the table out by the sandbox, Mom. You and Felix can eat there."

Gloria Griswell stared after him as he went into the house, then bit her lip.

Muir said, "What's wrong with the spot?"

"Let me show you."

They went down the walk, over a little footbridge across a brook that now in the summer was reduced to a trickle, and then along a narrow path through thick young pines to a little sunny clearing containing a small very clean table, two benches, and a sandbox.

"For the children's picnics," she said.

In the warm stillness, he looked around at the dense pines, "It does look unusually private."

She divided the various burgers and drinks. "Marius has a maze of tunnels through the lower branches."

"He could pop through anytime?"

"And will."

They ate in silence, then he said, "I'm not usually tongue-tied. But—"

A trapped look momentarily crossed her face, and he glanced around. "But I haven't wanted to ask about the device Dr. Allen showed me until there was more time to talk." She flashed him a grateful look as young Marius popped out from the pines.

"Mom, is the ice-cream in the freezer?"

"Why don't you look?"

"Because you left the wash on the freezer in a clothes basket."

"Can't you—"

"It's wet. You didn't put it in the dryer."

"Then—"

"I could get it off, but it's heavy, and it might spill. And the floor's filthy . . . Because, remember, you forgot—"

"Never mind," she said.

Muir thought that he could now guess what Allen had been thinking when he implied that Gloria Griswell was handicapped in the marriage market. He said, "I'll be glad to move the clothes basket, Mrs. Griswell."

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Marius said, "Mom's name is—"

She said, "Will you get out of here, Marius?"

"Why can't Felix—"

Muir turned to her. "May I call you Gloria?"

"Yes!"

Marius grinned. "You sound—"

"For heaven's sake! Marius—"

Muir smiled. "I'll help Marius look for the ice cream. After all, no one can talk and eat at the same time."

She said, "I'm not sure of that, but it's worth a try. If you'll move the basket, I'll see if I can find the ice cream. Maybe we could even have some ourselves."

Marius said shyly. "There might be a little left."

Muir had expected to leave in an hour or two, but found himself, toward four o'clock, putting Sally in her crib. Sally, who had her mother's enchanting smile, clung to Muir's hand, smiled up at him, then put her head on her pillow, sighed sweetly, and shut her eyes.

Gloria Griswell looked down unbelievingly into the crib, glanced at Muir, and bit her lip. Muir followed Gloria out of the room, glanced back at Marius standing with innocent satisfaction beside the crib, and murmured, "Is Marius staying with Sally?"

"Evidently," said Gloria.

As they started down the stairs, Muir kept his voice low, "Could we talk about the touchstone?"

"All right."

"It's in my car."

"I'll go with you. There's something I have to say."

He led the way outdoors. "Did you want to get in?"

"I . . . Yes."

He held the door for her, then got in the other side.

She sat looking at her hands. "I'm willing to help you learn about the touchstone. But I—" She paused, and turned to him in silence.

He studied her look of bleak determination, and said carefully, "If you are trying to tell me not to presume on any momentary sympathy between us, or not to imagine that Marius selects your friends for you, you'll have to say it. I'm short on tact, and make it up in stubbornness."

She looked at him in silence, then her eyes went shut, she looked away, and tears ran down her cheeks. Her voice was a whisper. "I'm trying to—to keep you from being entangled in a—fate worse than death, by Marius."

"You think Marius . . ."

"He's afraid his blockheaded mother will attract some unsympathetic fellow that he and Sally will then be stuck with. He likes you, so he's doing everything he can to throw us together. He knows Sally is a little demon when she gets mad, and he doesn't want you to see that. He's been so busy driving men away that it took a while to grasp his latest tactics."

"I liked you before he had a chance to do a thing."

She blushed, then said stubbornly, "At the risk of sounding even more silly than I must already, you don't want to get entangled with a widow with two children."

He nodded. "In principle, that's true. And you don't want to get mixed up

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with someone too dull to understand tact. Still, on the other hand, a lot depends on specifics. Which two children? Which woman? You can't deal with these questions in generalities. Have you considered the details?''

She said, ''I'm beginning to be sorry I tried to save you.''

''That's all right. I appreciate the gesture.''

After a moment, she sighed. ''Where were we?''

''You were going to tell me about the touchstone.''

She nodded, and he got the briefcase, and they went back into the house.

She led the way down the hall, to a paneled white door with a brass knob.

''Marius's father used this room as a study.''

Muir looked into a large dim room with book-lined walls, comfortable chairs and sofa, and a closed rolltop desk.

She turned on a floor lamp, and pushed up the curving slide of the desk, to reveal numerous pigeonholes and shelves. On two shelves lay a pair of books, which she placed, face-down, on the writing surface of the desk. She took the touchstone, aimed its little cone at the first book, and pressed the right-hand grey button. There was a singing melodious note.

She turned the cone toward the second book. The touchstone gave a sickly groan.

Muir picked up the first book, to recognize a chemistry text of the early 1900s. The author had used care to distinguish fact from the theories of his day, so the book was still useful. Muir picked up the second book, didn't recognize it, and read:

''. . . . is 'at random.' Like when you're shooting craps you don't know what numbers will turn up. Or when somebody gets high, you don't know what he or she will do. This is at random.

''When these mollies bounce off each other, and hit the wall, it is at random. But when they hit the wall, their push makes a pressure. You can measure the pressure.

''CHEMFACT: Maybe you can tell what will happen even when the thing that makes it happen is at random.

''NEWWORD: Mollie. Mollie-cule. Mol-e-cule. Molecule. See?

''CHEMQUIZ: 'When people get beered up, is it at random?''

Muir flipped to the front of the book, to learn that ''this is the first in a new series of science texts designed to relate intimately to today's more demanding student.''

Gloria Griswell watched the expressions that crossed his face, and smiled. ''The left button gives a reading on the meter. The right button gives a tone. The meter can measure small differences. The tone can differentiate all sorts of things.''

''It's a touchstone for quality of workmanship?''

''As nearly as I can judge.''

''It will work on what?''

''Anything man-made.''

He let his breath out carefully. ''No wonder Allen wouldn't give details. All right if I try it?''

She handed the device to him.

Muir aimed the cone at the desk itself,

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and pushed the right-hand button. A singing note sounded.

He tried the left-hand button. This time there was silence, but the needle swung far across the dial from left to right.

Muir glanced around the bookshelves, to a green plastic hand that held aloft a pot metal ashtray. He aimed, pushed the right-hand button. The touchstone emitted a croak.

Muir went methodically around the room. Usually the device gave a pleasant tone. But it made no response to the potted plants that sat on a window sill, and it made groaning, croaking, or bleating noises for a stoneware spider with nine legs and a built-in clock that didn't run, for a small doll in a bikini that shot from its mouth a cigarette-lighting flame, and for a printed invitation, preserved in plastic:

"Congratulations! Our sophisticated computer analysis has revealed a small select group of individuals who capably manage their own affairs. You are one of this select group! Now, for a limited time, we invite you to place at your disposal the limitless credit and extensive financial resources of our prestigious exclusive organization . . ."

Muir turned the plastic over, to find on the back a lengthy questionnaire in fine print, along with a little notice:

"DO NOT apply for Credit Approval if your income is below $39,900.00. Return the enclosed Card AT ONCE by Registered Mail!"

Like an insect preserved in amber, the credit card itself was embedded in the plastic, made out to "Marius Gristmill, Sr."

Muir aimed the cone-shaped coil at the card; the touchstone emitted a sickly bleating noise, several times repeated.

He looked up. "I have to agree with its sentiments. But I don't begin to understand it."

"I didn't mention understanding. I only said I would show you."

"Do you understand it?"

"I know what it will do. That's all."

"It won't work on people?"

"It will respond to clothing or accessories. There's no response to an individual, as far as I know."

"Did Dr. Griswell ever explain this?"

She nodded ruefully. "More than once."

"What—"

"The explanations varied."

"Why so?"

She shook her head. "His sense of humor. He said once that the lab had deciphered the genetic codes of the nose of a cat and the vocal organs of a goat, translated them into machine language, and burned the result into an EPROM installed in the touchstone."

As Muir grappled with this, she added, "So they had a program that could smell a rat, and say what it thought of it in sounds anyone could appreciate."

Muir became aware of a catch in her voice, and stopped asking questions. He sat down on the couch, and set the device carefully on a low table nearby.

She blew her nose, and after a moment's silence, said, "Does the touchstone make problems?"

"Unless there are circuits inside that are complicated beyond belief, and sensors to match, I'm afraid the touchstone is 'scientifically impossible'—unless Dr. Griswell made it as a joke."

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"A joke?"

"Well, he could have embedded, in items around this room, tiny devices —like what's detected when a book is taken out of a library without having been checked out. The touchstone would give the reading, or the kind of sound, that had been encoded in advance."

She shook her head. "It will work on things that are brand-new as of now. How can you say it is 'scientifically impossible'?"

"If it works, of course it's scientifically possible. I mean that it looks incompatible with present-day scientific assumptions."

"But it does work. And it's useful. Yet Mr. Kenzie and Dr. Allen seem embarrassed by its existence."

"A genuine touchstone is something some people—I'm not thinking of Mr. Kenzie or Dr. Allen—might not want around."

"Does that matter?"

"Say we have a text written by Bungle, Murk, and Damnation, and published by Confusion Booksmiths. The school board runs a touchstone over this text, and never wants to see the book again. Confusion Booksmiths rises up a hundred feet tall in the law courts to demand proof from whoever made the touchstone that it is scientifically valid. We then have the problem of proving the scientific validity of something that does not conform to present-day scientific theories."

"To sell it would bring about situations in which an explanation will be demanded?"

"It seems so to me. And then what?"

"What *is* the explanation?"

"That's a question I've been trying to answer." Muir turned the device over in his hands. "Is it all right to open this?"

"As far as I know."

He got out an all-purpose Swiss pocket knife, and carefully undid four screws. Very cautiously, he lifted off the back of the case. After a lengthy silence, he looked up.

"However this device may judge quality, it doesn't use any method humans would use. I have the impression I'm looking at some variation on the Geiger counter."

"How—"

"Conceivably it counts something emitted from the object the coil is aimed at."

"Is that bad?"

"For whoever has to explain it. What does it count?"

She nodded. "I see."

"What is it again that this works on?"

"Anything man-made."

"But not on anything that's not man-made?"

"I don't think so. Marius would know better than I. But that's my—"

The door opened, and Marius looked in, "The touchstone only works on man-made objects. Dad showed me. Mom, I wanted to tell you Sally wants to get up. But I didn't want to interrupt when I heard you and Felix talking."

Muir listened with conflicting emotions as Marius went on: "I can show Felix more about how the touchstone works. But it's getting late, so maybe you could make supper. And we've got the extra room, so if Felix wants to stay overnight—"

Muir glanced at Gloria Griswell, who

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stared for an instant at her son, then turned to Muir, who said, "I appreciate the suggestion, but I think I should get back."

Marius said, still speaking to his mother, "You remember what happened the night before last, Mom? It wouldn't hurt to have a man around the house."

Muir started to speak, paused, then said, "What happened the night before last?"

Marius said, "Someone broke in."

"Marius," said Gloria, "we aren't sure—"

"You heard it, Mom. And the window was unlocked the next morning. And someone had gone through the desk. Sally was scared to death, and so was I."

Muir said sharply, "What desk?"

Marius pointed silently to the rolltop desk.

Muir said, "Was anything taken?"

"We don't think so," said Gloria.

Marius said, "Whoever did it might be back."

Muir said, "In that case . . ."

The sun was low in the sky next morning as Muir pulled into the company lot, parked, and went inside. He had just locked his attaché case in the old-fashioned safe when there was a knock, and Dr. Allen looked in.

"Muir, Mr. Kenzie and I would like to talk to you."

Muir followed Allen down the hallway, through an unmarked door, and up in a small elevator. They crossed a short hall, to an office where Kenzie, his suitcoat over the back of a chair, tie half-undone, prowled like a caged panther. Kenzie paused at the window to glance out, then turned to Muir.

"What do you make of the touchstone?"

"A useful device."

"Which does what?"

"Measures the quality of human workmanship."

Kenzie glanced at Allen.

"That's where we got stuck."

Allen nodded soberly.

Kenzie looked back at Muir. "We have got to get moving on this. You've had little enough time, but let's hear your impressions."

"At first, I thought the touchstone might be a joke, detecting something Dr. Griswell had already put in the objects it judges. But Gloria said it works on things made recently, and it does."

Kenzie looked at him sharply.

"Mrs. Griswell helped show you how it works?"

"Yes."

"She has a fiancé. Did you meet the—"

"He was there when I got there."

"You met her family? A son and daughter?"

Dr. Allen said drily, "Both delightful."

Muir smiled, and nodded. "Nice kids."

Allen stared. Kenzie looked momentarily blank, then said, "Do you see any way yet to market or even explain the touchstone?"

"To explain it, yes. But I'm not sure . . ."

Allen said, "Namely?"

"Well . . . People judge workmanship by appearance, performance, and comparison with some standard. This

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device does it some other way; the works suggest a radiation counter. But what's counted? Could there be a form of radiation that gives a measure of quality of workmanship?'

Allen said, "If so, where would you go from there?"

"Then the operation of the device would be possible to work out. But first there are some trifling little problems in identifying this radiation."

Allen nodded. "Not least of which is that 'quality' and 'workmanship' relate to subjective human judgements, and they are being measured objectively by an instrument. The explanation will blow up in your face."

"Unfortunately, there so far seems to be no alternative. For the sake of argument, why should that create an explosion?"

"Science," said Allen, "is based on objective repeatable experiments. The judgement of quality rests on what is essentially a subjective sense of esthetics, combined with various aspects of experience. There's no connection."

"The touchstone works. Therefore there must be a connection."

"There can't be."

Kenzie straightened his tie. "There's no connection between 'objective experiments' and 'various aspects of experience'?"

"No relevant connection. Quality of workmanship involves human esthetics; human esthetics is not an objectively measurable quality."

Muir nodded. "Obviously, that's true. But we're up against something still more basic than that, and that has been shown over and over again. It's why there's a bloodbath every now and then between science and philosophy."

Allen looked at Muir in foreboding. "What?"

"Argument doesn't refute facts. Facts dominate. An argument only interprets facts."

"But what—"

"The touchstone exists. It is a device based on science. It accurately judges the quality of workmanship. Therefore workmanship must be objectively measurable."

Kenzie glanced at Allen.

Allen exhaled slowly, and nodded. "It's arguable in the case of a structure or a machine. There esthetics may depend on function. But what about modern art?"

Kenzie nodded. "Doc had two touchstones, Muir. One he kept at home, one in a safe in his office. We tried out the one he kept in his office. Among other things, we took it to a museum, to see if it would judge art."

Muir remembered the green plastic hand and pot-metal ashtray. "And it did?"

Kenzie nodded. "And it actively disliked most modern art."

"What did it—"

Allen shook his head. "You can't imagine. The noises it made brought a guard on the run. He thought we were sick."

Kenzie said, "The only way we see to market this thing is as what it seems to be . . . a detector of quality workmanship. But how do we prove it? And what happens when the museum, for instance, discovers that most of the exhibits in that priceless collection have been 'scientifically' graded as junk?"

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Muir thought it over. "The touchstone could be right."

Kenzie nodded. "Ninety percent of those expensive exhibits could be the worst kind of artistic trash. But how does that help us? Whoever the touchstone damages financially may try to recover. He may very naturally try to recover by means of a lawsuit. If we claim that the touchstone is what it seems to be, we have to be able to prove it."

"Where it judges technology," said Allen, "at least we can argue the case; but it will judge any kind of workmanship. Outside the museum, there's a pedestal that holds up a thing like a—ah—like a—"

Kenzie said, "Like an oversize bronze pretzel with its hands in its pockets."

Allen nodded. "Exactly. You don't dare get anywhere near that piece of statuary till you've shut off the touchstone."

Muir laughed. "That's a reason to question its judgement?"

"Legally," said Kenzie, "yes, it is. That bronze pretzel cost the museum sixty thousand dollars. Just suppose our device should knock the market price down to the scrap value of the bronze? The museum will naturally think they've been damaged by false claims. How do you defend a thing like this in court?"

"I don't know,"

"Doc was a genius. My impression is that the touchstone sees through slipshod work and confidence stunts, artistic or otherwise, as an x-ray sees through tissue paper. But we may have to prove it. How?"

Muir said, "Gloria would like to see the touchstone produced and sold. She thinks it could do a lot of good."

Kenzie nodded. "We all have to rely on specialists; and it's all but impossible to judge their work except by results, and then it's too late. The touchstone could help. Suppose you need a car. You aim the touchstone, push the button, and if there's a groaning noise, you walk off the lot. That's better than buying a lemon. But again, if this happens often enough, what's the manufacturer likely to do? Attack the touchstone. How do we defend it?"

"Maybe we're approaching this from the wrong direction."

"It could be," said Kenzie exasperatedly. "The whole thing is skewed, off-center, and hard to grasp. What's your thought?"

"The better we prove the touchstone is right, the worse it makes the problem. We're vouching for the truth of what the victim sees as slander."

"The touchstone unmistakably detects quality workmanship. That's a slap in the face to the sellers of all the inferior goods on the market, but it's true. To compound the problem, the touchstone is scientific, but sounds like a joke. If Doc hadn't invented it, I wouldn't touch it."

Muir said, "But that may be the answer!"

"What?"

"That Doc Griswell invented it!"

Kenzie shook his head. "The whole problem is that Doc isn't here and can't explain it. Believe me, when Doc got on the witness stand, the opposition had troubles. But he's not here. How do we explain what only he, if anyone, understood?"

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"But since he isn't here, how does it help to argue that the touchstone's judgement is scientifically accurate? It's better the other way around."

"How . . ."

"Why not call this 'Doc's Legacy,' say that Doc left this behind, you don't want to withhold it, because it seems useful; but you don't know for sure just what it does. You think Doc used it as a touchstone for good workmanship; but does it give exact truth, or a curmudgeon's viewpoint, or the facts as Doc saw them, or what? Anyone can try it, and see for himself. It would still be just as useful. But you would have sold it as an intriguing puzzle, not as an infallible electronic judge."

Kenzie looked thoughtful, and glanced at Allen.

Allen rubbed his chin. "It might work. Would Gloria be agreeable to this?"

Muir said, "I expect to see her tonight. I can ask."

Kenzie nodded absently, then joined Allen in a close look at Muir, who missed the look, as he said, "Incidentally, what you would be saying would be the strict truth. Who can say what Doc Griswell was trying for, or for sure that he got it?"

Another look passed between Kenzie and Allen. Muir, who saw this one, was reminded of parents debating whether to reveal some jarring fact of life to their offspring.

Allen gave an embarrassed cough. "Well, Muir, that question involves something I—ah—hadn't mentioned to you as yet. There was a discarded first draft of a patent application in Doc's desk. It includes a theory to the effect that the human mind, in a particular creative state, produces 'alpha-psychons,' which, impinging upon matter, in turn cause certain changes, such as the radiation of what are tentatively called 'qualitons.' There is a large faint X pencilled across the cover page of this mind-boggling document, along with a big question mark. What the theory hypothesizes is nothing less than interaction between mind and matter, with the touchstone detecting 'qualitons,' to prove the theory. Of course, it is in this creative state that high-quality workmanship is achieved, and the touchstone judges it by the qualitons emitted."

Muir tried to speak, but words wouldn't come.

Kenzie said drily, "Doc had these inspirations from time to time."

Allen said, "But usually he took care of them himself. This is the first one we've had to contend with on our own."

Muir exhaled carefully. "Is the theory comprehensible?"

Allen thought the question over. "Well—"

Kenzie said, "Not to ordinary human beings."

"Doc," said Allen judiciously, "usually made considerable use of mathematics. The problem is that there were times when no one else could follow his math. That's not to say that the math isn't valid. But there is that problem of following it in this case. Much worse is that there are parts that are not mathematical and that will be automatically rejected."

Kenzie sighed. "In addition to which, he uses a theory of atomic structure—"

"Subatomic structure," said Allen.

"Atomic substructure," said Kenzie.

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"If an atom were a house, Doc would be talking about the composition of the bricks the house is built of. You not only have the complications of Doc's math, but also the complications of this theory to which Doc was applying his math. Plus the alpha-psychons. Taken all together . . ."

Muir kept a firm grip on his choice of words. "Does the part of this theory that is comprehensible seem self-consistent, assuming you don't automatically reject it?"

Kenzie glanced at Allen. Allen looked thoughtful, hesitated, then finally nodded. "I suppose in that respect it's a little like the quantum theory, when it was first proposed. You have to accept certain assumptions you don't want to accept; but if you do that, the rest becomes reasonably clear—except that in this case we have the theory without the theorist, so it is not easy to follow the details."

"But the details you can follow?"

"Well—it depends. There is one aspect of this, Doc called it 'the remote resonance force' I think, that could make special trouble. You see, the touchstone not only reacts to the original inspired plans for a device, but to later reproductions of the device, very possibly made by not especially inspired people routinely following the plan. How do the alpha-psychons radiated in March of one year, in Boston, create qualitons in Savannah, Georgia, two years later, when the blueprints are turned into reality? There's a problem there. Doc may have four pages of mathematics and two special theories between Boston and Savannah; but there are going to be people who skip all that, and intuitively reject the idea."

"The 'remote resonance force,' " said Muir, "explains how this could happen?"

Allen glanced helplessly at Kenzie. Kenzie smiled. "With Doc on the other end of the theory, the 'remote resonance force' is like a sixteen-inch gun aimed at the critics. Most of them wouldn't want to face the monster projectiles Doc could fire from that cannon. Unfortunately, we don't know how to load the thing."

Allen said exasperatedly, "And Doc very evidently was dissatisfied with something about the theory."

"Yes," said Kenzie, "or he wouldn't have put an 'X' across it and tossed it in his bottom drawer."

Muir said, "But, the touchstone works."

Allen nodded. "All told, the mathematics is baffling but very possibly valid; the theory of matter to which the math is applied is anyone's guess; the device itself works. But the idea behind it all is going to be just as nice to put across as Galileo's original argument."

"Yes," said Muir. "I can see that."

Kenzie said, "But your suggestion about marketing the touchstone is a help, Muir. We're going to have to think that through. It's the first progress we've made with this thing in quite a while."

"But how does it fit in with that patent application?"

"As far as I can see, it doesn't. But don't worry about it. Ah—You said you were going to see Gloria Griswell—?"

"Yes, for dinner tonight. And I'll ask if she's agreeable to marketing it that

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way. But—" He paused, baffled at Kenzie's wistfully hopeful expression.

"Don't worry," said Allen, following Kenzie's thoughts easily enough. "It's like a jigsaw puzzle, Muir, and you've just given us a good-sized piece. You've had very little time to work on it, but it's a pleasure to see how you've taken hold of the problem. It's a relief to see this . . . ah . . . this last work of Doc's moving again."

Late that day, with the sun at the horizon, Muir was in the little clearing with Gloria when Marius spoke:

"Felix?"

Muir looked blankly around.

Overhead, something moved against the deep-red sky.

Muir glanced up, to see Marius, apparently floating face-down by the tops of the evergreens. Marius said, "Why don't we write out our ideas about the touchstone, then use the touchstone to judge them?"

Muir heard the words, but didn't answer as he stepped aside, eyes narrowed, to look up at Marius from a different angle. Muir had the impression of looking up from the bottom of a pool at a swimmer on the surface. Obviously there had to be something holding Marius up, but so far all Muir could see was *the thin pale-blue thing* Marius was lying on, and it appeared to be unsupported from any angle.

The slender tops of the evergreens moved in a light breeze, and Marius, looking down at Muir's face, grinned suddenly, and slid sidewise in the air, gathered speed, and shot off to the side out of sight, streaked back from a different angle, much higher, then dropped like a rock to brake to a stop, and hover motionless, overhead.

Muir, looking at the pale-blue something Marius was lying on, belatedly recognized Marius's "flying carpet," a gift from his father, Doc Griswell. Next he remembered the feel of fine wires when Marius had pressed the "blanket" to his fingers.

It dawned on Muir with a shock that the idea of taking care of 'Doc's last work' was premature. Here was another of Doc's working models. Like the others, it came with no warning, with no one knew what complications to follow.

For the first time, Muir felt sympathy for people who had bet against the incandescent light and snorted at the thought of a carriage with no horse. Progress was fine, but the touchstone had yet to be worked out, no one dared say whether Doc's asterator would save humanity or wreck it, and here was this thing.

And why would Doc Griswell make a toy of an invention that, on a large scale, could lift man off the earth and truly begin the Age of Space? Why, for that matter, had Doc just used the touchstone himself, when he could have got it into production? Legal uncertainty might stop Kenzie and Allen, aware they didn't understand Doc's device; but *would it stop Doc?*

It was then that Muir thought of the patent application with the question mark and the X across it.

What if Doc didn't understand it, either?

From time to time, someone uncovered something really new, perhaps just as everything seemed finally explained and systematized. The results could turn

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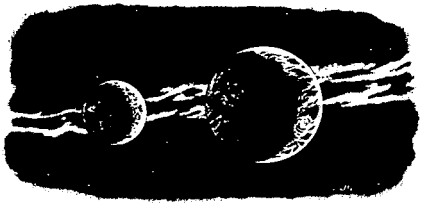
civilization on its head. To most of the survivors, it might some day seem perfectly clear, one of life's familiar certainties. But those who had known other certainties tended to be more cautious.

Now, looking up from below at something really new and revolutionary, Muir winced.

Looking down from atop it, Marius grinned. ■



IN TIMES TO COME

● Our lead story for March, with cover by Laura Lakey, is "Water Rite," by *Analog*'s former editor, Ben Bova. One of the things mankind has been learning in recent years is that things on this planet are so interconnected that many things long assumed to be purely local concerns can no longer safely be viewed that way. What's done in one place has effects in others, and those effects can be too large to be ignored—particularly when things are being done on a modern industrial scale. In this country, for example, how midwestern factories burn their fuels turns out to be of very immediate concern to people who manage northeastern forests. So far, at least, that does not seem to pose a *military* danger—but what if the problem is a water project in one North African nation that threatens a huge aquifer also used by several others? That could easily threaten large-scale, dangerous conflict—unless the project's own technology has within itself a subtler means of defusing the danger.

Also in next month's issue, Thomas Donaldson has another of his fact articles that attempts to look well beyond the immediate future. This one is "The Farther Shores of Fusion." Fusion power now looks like something we very much need, and can reasonably hope to have in the relatively near future—but in a form which will surely look quite primitive to our descendants. Given continuous development from where we are now, what might they be doing with fusion in, say, five hundred years?

And, of course, we'll have the usual diversity of shorter stories, including some by Timothy Zahn, J. O. Jeppson, and Elizabeth Moon, plus a guest editorial by Gregory Benford on "The Future of Disaster."

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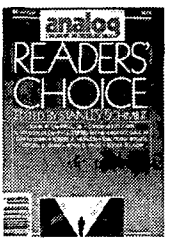

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the reference library

By Tom Easton

The Forge of God, Greg Bear, TOR, $17.95, 473 pp.
The Fall of the Republic, Crawford Kilian, Ballantine/Del Rey, $3.50, 304 pp.
Dirk Gently's Holistic Detective Agency, Douglas Adams, Simon & Schuster, $14.95, 247 pp.
Madbond, Nancy Springer, TOR, $2.95, 214 pp.
The Alexandrian Ring, William R. Forstchen, Ballantine/Del Rey, $3.50, 304 pp.
The Net, Loren J. MacGregor, Ace, $2.95, 225 pp.
Copernick's Rebellion, Leo A. Frankowski, Ballantine/Del Rey, $2.95, 202 pp.
The Paradise Tree, Diana L. Paxson, Ace, $2.95, 243 pp.
The Luck of Relian Kru, Paula Volsky, Ace, $2.95, 294 pp.
Lost in Time and Space with Lefty Feep, Robert Bloch, Creatures at Large (P.O. Box 687, 1082 Grand Teton Drive, Pacifica, CA 94044), $12.95, 258 pp.

The book that may well win the next Nebula and Hugo awards is something of a curiosity. For one thing, a lot of wheels do a lot of spinning, but the story is remarkably passive. For another, it has no heroes; every single character is a nonentity, powerless to affect events, powerless even to decide his or her own destiny, and it can be no other way.

So what else is new, you say? It sounds like life, not fiction? Then perhaps Greg Bear, like you, is a fatalist. Maybe he too believes we are powerless. Certainly, he claims in his latest, **The Forge of God,** that most of the human species, and almost all of Earthly life, and even Earth itself are doomed beyond all possibility of redemption.

But. . . . Ah, that but! There are forces at work that will save a chosen few.

And no, despite his title, Bear has not written a religious story. It's millennial, for it is set in the late 1990s and it in-

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volves the destruction of the Earth and the ascent of the few to heaven, but there are no gods, no devils. One day three geologists find a new volcanic cone in Death Valley. It looks dead, but it's not on the maps. And then they find the alien, who, once in government hands, claims to be a stowaway on a robot ship which destroys worlds, a von Neumann exploration device that reproduces itself from the materials it finds and to which life is irrelevant. But there is a similar rock in Australia, with robots that claim to be benign emissaries of higher civilizations among the stars but self-destruct when told of the Death Valley alien. And then there are the strange devices that splash into the sea, raising tsunamis, and bore into Earth's core; the best guess—offered by an SF writer in a live-broadcast interview—is that they are the two halves of a matter-antimatter bomb that will explode the planet when they come together in a few months.

No heroes. Just viewpoint characters. The geologists. An oceanographer. An ex-science adviser to the president, now drafted to help study and resolve the situation. A science writer and novelist. All powerless, helpless. There is no way they can save their world, or their lives. They can only cope, and finally die, with more or less grace.

But then the spiders appear. Small robots that forge links to the minds of selected humans and direct them in collecting libraries and contacting other humans, they are the emissaries of another civilization, one bent on wiping out the planet-eaters and on saving as many of the victims as possible. And we watch, biting our nails, gritting our teeth. Will the spiders succeed? Will their ark-ships survive the attacks of the planet-eaters? Will our favorite viewpoint characters be selected to survive? Will their friends and families?

Once we have our answers, Bear gives us two of the most painful passages in SF. In lovingly imagined detail, he sets a few people, including two of the geologists with whom the tale started, in Yellowstone. They are there to express a love for the Earth on a personal, intimate scale, and they are to ride the mountains down into ruin. Then he moves into space where, in just as glorious detail, he expresses his love for Earth as a whole. With him, we weep as the Earth explodes and disintegrates, and a child, selected to watch—it is the Law that the villainy be witnessed by its victims—says, "If I don't see, I won't know how mad I'm supposed to be."

The Forge of God is a fine and potent masterpiece that deserves your attention. If it has a weakness, it is a small one, its last chapter, which adds a note of hope, but also one of unnecessary vengefulness. The book would have ended perfectly with the last line of the penultimate chapter.

Also millennial, also set in the late '90s, also presaging a destruction of the world—this time from without, by a mysterious fiery sword—is Crawford Kilian's **The Fall of the Republic.** This is the second novel in his Chronoplane Wars series (following *The Empire of Time*), and the one in which humanity discovers the chronoplanes, alternate worlds that match our world's history at various times. The destruction is of an "uptime," future world, where even the atmosphere is gone. Downtime worlds are still green, and the parallelisms are so close that Kilian can even put George Washington on a talk show. A neat conceit, but strictly an off-the-cuff side joke here. Kilian's point is that uptime world, which scares the pants off his characters.

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His stars are Trainables, the one in eight of adolescents whom he says can, with the aid of certain treatments, be given the ability to absorb and process information at computer speeds. Another neat conceit, and one that raises a class of *Übermenschen* loyal to the existing order and dedicated to saving our society from the economic, political, and ecological collapse we have created. Naturally enough, un-Trainables hate and fear Trainables, and some Trainables see the only answers to the world's problems not in service but in clandestine rule. One is Eric Wigner, who works for the CIA; he spots Jerry Pierce, a super-competent Trainable with a knack for direct and appropriate action, and drafts him into his plans. Then come the chronoplanes, and Jerry must go through the gate to rifle the CIA's uptime files. He succeeds, though he may have drawn the attention of whatever destroyed that Earth, and Wigner has the information he needs to abort a rebellion and get the U.S. into a world government.

Kilian has a nice hand with his characters. We empathize with Pierce's psychic agonies, even though we may feel that Kilian has overdone them. We feel that Wigner's schemes make him a villain, but we recognize the worth of his goals and the sliminess of those who oppose him. But these characters do not quite come alive, perhaps because of the alienness which the Trainables' information-processing speed gives them.

Kilian is less ambitious here than Bear, but the series bids fair to be a very satisfying example of the kind. I am already looking forward to the next volume. I expect it will bring the first of the Chronoplane Wars by explaining the mysterious events that accompanied Pierce's hasty departure from that dead uptime Earth.

* * *

Douglas Adams, of *Hitchhiker* fame, is with us again. And again he gives us his unique blend of straight-faced silliness and understatedly skewed logic with the end of the world. If it doesn't work quite as well as it did before, that is because we have been immunized by our prior exposure. If he still keeps us smiling, that is because he has lots of room to slip within the bounds of his success.

The new book is **Dirk Gently's Holistic Detective Agency.** It opens with a scene of primeval desolation; switches to an Electric Monk, a robot designed to believe in things, who passes through a plain white door from his world to ours; gives us Professor Urban Chronotis at an Oxford look-alike, who seems to have nothing to do on campus but accomplishes the most astonishing magic tricks; and tells us that Coleridge actually did not fail to complete "Kubla Khan."

And here we begin to twig: The professor has to be a time traveler, the Coleridge clue reveals that here is an alternate world, and *something* will happen to bring the novel onto the timeline more familiar to us.

The story's protagonist is Richard MacDuff. His employer, shot by a mysterious assailant, becomes a ghost of baffling difficulties. MacDuff, driven by his own problems, falls into the clutches of old acquaintance Dirk Gently, once a youth of apparent precognitiveness, now a private detective with quantum mechanical leanings and a tendency to rip off his old-lady clients. And then there is Michael Wenton-Weakes, a very Wodehousian upper-crust nitwit, who is possessed by a spirit that wishes to change the dank and dusty past from which it comes.

And it all falls together, rather more

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neatly than ever it did for the *Hitchhiker*, and with the kind of anticipated click that makes us enjoy some of the best detective stories. It's wacky, yes, but given the premises, it has all the inevitability of a boulder rolling downhill.

Nancy Springer begins the "Sea King" trilogy with **Madbond,** and just as you might expect from this author, the book is excellent. She gives us a world, maybe Earth of the far-distant future, in which life is strangely limited. There are memories of a time when bears, wolves, falcons, elk, and other wildlife species thrived, but they are no more, except for a few feathers and pelts in the possession of royalty.

You suspect that wicked humans have wiped out the wildlife? Apparently not, for in all the world, says the traveler Tassida, there are but the six small tribes that live in one small area, of roughly the size and climate of California. Were there ever more? Tassida reports ruins and tells tales that make me suspect that a future volume will reveal a time machine lurking in the background, but local history holds no memory of anything but life as the locals know it.

But then there are the devourers. These flying monstrosities, immune to knives though fearing flame, wrap around humans such as Rad Korridun, king of the Seal Kindred, and try to absorb them. They can be repelled by strong will, but if that will is not quite strong enough, they can invade their victim and turn his or her will to wickedness. Behind the devourers are visions of a watery Hades, ruled by a being ravenous for life of all kinds.

And one night, as Korridun stands vigil against the devourers and other foes, a raving madman, bearing a metal sword in an age of stone, storms through the wall and attacks. The madman is Dannoc, prince of the Red Hart tribe, and his madness is such that he remembers nothing of his recent past,not even his name. Korridun takes away his sword and nurses him back at least to relative sanity. They become fast friends, and in time they decide to venture forth, to explore their world, to search out the truth behind the returning shreds of Dannoc's memory. As they leave, Tassida appears with tales.

Before long, the shape of things to come turns clear. The culture of Korridun and Dannoc holds tales of a Christ figure, a creator, a life affirmer, who died and rose and will come again. One of the heroes dreams of him, and later he does things that suggest he will indeed save his world before the trilogy is done.

Madbond is excellent, but somehow I am not looking forward to its sequels. The book stands so well alone, as a paean to friendship that withstands pain and madness and destiny, to a bond in fact forged of pain and empathy, that it needs no more. Springer has a hard task ahead if she is going to match her performance here.

I have, from time to time, inveighed against the pornography of violence. It has risen, like a tide of blood, to curse the SF&F field, to justify 50 years of accusations that SF& F is mindless, adolescent trash, as if the field had never produced a LeGuin, a Wolfe, an Ellison, a Delaney.

I do not like writers who cannot escape the mental and moral level of television, movies, and comic books, who sing the praises of spilling blood and guts on the ground in ever greater quantities, who glorify death and murder.

I do like those who can hint at reasons why we seem so fond of literary and

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subliterary violence. Bill Forstchen qualifies with his **The Alexandrian Ring,** the first volume of *The Gamester Wars*. He gives us a distant future, when humanity is centered on the Magellanic Clouds, which it shares with two other sentient species. All three had discovered the route to the Clouds simultaneously millennia before, and they had competed bloodily for worlds. But then had come the Overseers, strange aliens who forbade war and enforced their ban with superweapons. The response of the humans and their rivals was to replace war with gambling, betting on small-scale military conflicts between tribes and nations on the non-space-going worlds of the Clouds. In due time, there arose professional conflict or "game" organizers and wealthy gamblers who sponsored games and sometimes fixed them.

At the time of the story, the greatest of game organizers are the human Aldin and his one-time mentor, the Gavarnian Zergh. Aldin is employed by the crooked Corbin Gablona, who uses games to bankrupt his foes in business, and his present task is to kidnap Alexander the Great, Earth's greatest military strategist, bring him forward in time, and plant him on a Nivenian ringworld. Zergh's task is to do the same for the Gavernian Alexander-equivalent. The game will be the temporal exiles' struggle to rebuild their armies, and then to war against each other. Which will win? is the grand question, and empires are wagered on it.

Bill is no LeGuin or Wolfe. He writes on a more visceral, action-oriented level. But he is also thoughtful, and ironic. It would have been easy for him to have written this novel on the level of the pornography of violence, but Alexander and his counterpart were not only soldiers. They were unifiers, with dreams of civilization and peace, and in the end this aspect of their identities subverts the game, even as Corbin's and Aldin's side-schemes come to their various fruitions.

So what is Bill hinting is the reason for the present popularity of blood and guts in SF&F? His gamblers express a strong nostalgia for the "good old days" before the Overseers arrived. And I wonder if this is not what is going on in this country today. Look at Washington, Hollywood, the daily paper, and tell me I am wrong: We have had no real good wars for 40 years, and the American temperament—nasty thought! —does seem to thrive on murder.

With his very first novel, **The Net,** Loren MacGregor makes an intriguing addition to the furniture available for the next round of cyberpunk stories. His Net is the web of cybernetic connections, made possible by injections of gengineered bacteria that encourage new pathways in the brain and is activated by devices that plug into skull sockets, that link the members of a starship crew. In flight, each member of the crew becomes an entire nervous system dedicated to a single sensory modality —Sight, Smell, Taste, Feel, Hearing—in the Captain's more holistically functioning mind. The result is extreme closeness among the crew and between crew and captain, in flight and on the ground, ready communication, and a method for villains to betray, attack, and destroy.

The Net is the story of Captain Jason Horiuchi, youthful in appearance and health despite her century's age (thanks to certain side-effects of the Net), head of an interstellar corporation, jewel collector, and thief, this last verging on kleptomania. The Papandreou corporation is a major business rival, and the

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scion of its founder, the four-armed (more bioengineering) Alecko, knows enough of her secret mania to tempt her toward destruction: He has stashed a ruby of colossal size, beauty, and value in a museum showcase surrounded by the best security he could devise. If she can snaffle it and get away scot-free, he will bow out of their business competition. If she can't, or is caught, she will bow.

It's a lovely plot premise, and MacGregor does some nice things with it, exploiting the closeness of crew and Captain to provoke trouble, the Net to come close to disaster, and the Net again, and super-computers (known generically as "crays"), to save the day. In the process, he shows us an interstellar society dominated by Greek culture, pervasive unisexuality to the extent that even names no longer offer clues to gender, and more lovingly imagined bioengineering (guess why Bear Vouris, because of her pelt, had to give up singing opera).

Unfortunately, MacGregor spends so much of his time slinging marvels at the reader that he neglects, to my mind, to bring his characters fully to life. In addition, *The Net* winds up feeling like a string of connected short stories or, worse, anecdotes. I suspect the original manuscript had to be cut drastically, leaving noticeable holes. But between the holes, MacGregor shows signs of potential greatness. Watch for his future works.

I savaged Leo Frankowski's *Cross-Time Engineer* for coming a tad too close to Mark Twain. I am now delighted to have the opportunity to be nicer. The occasion is Frankowski's **Copernick's Rebellion,** which, though it is not as ambitious or great a book as it might have been, is original, delightful, and very much the proper cup of tea for *Analog* readers.

The gimmick is a pair of aging genetic engineers, Heinrich Copernick and Martin Guibedo, who, having mastered rejuvenation, use it to bribe Congress to keep hands off while they introduce gengineered trees that provide food and other amenities for free. There are also Labor and Defense Units—dinner plates on legs and with eye stalks—gengineered from animals, feminoid fauns to serve as servants and baby-sitters, and truck-like transport units, among other things. And all are free, self-reproducing; the trees, for instance, growing from seeds that owners must promise to give away on request. Furthermore, they are guaranteed not to overrun the world, for they are symbiotic with each other and with humans (though Frankowski does introduce a note of doubt here, just to keep things realistic).

However, the world's economies depend on the manufacture and sale of goods, and governments, generals, and bankers all see the "Symbiotic Revolution" as a threat. In fact, it is. Of course it is. It is redefining economic realities in such a way that "labor" and "money" will be obsolete terms.

There are war, chaos, social breakdown. But Copernick and Guibedo pull the new order through, and we glimpse the dawn of a Utopia that just might work. For a while. Until the people catch on to just what is really going on.

Frankowski has here a satisfying example of idea-based SF. It is not, however, great, for it is shy on characterization and setting. It is also simplistic, for the revolution succeeds much too easily and the gengineering is far too straightforward (as well as cursed with some unfortunate and impossible views of methodology; the author has Guibedo building genes nucleotide by nucleo-

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tide, personally, unaware that such a task would take centuries, not hours). But what the heck. The tyrants and bureaucrats get stuffed, tree houses and all the rest are enchanting notions, and the tale is fun. Go forth and enjoy.

I greatly enjoyed Diana Paxson's *Brisangamen,* which brought Norse mythology to life in San Francisco. It was lively and enchanting, and it had that feel of truth so rare in fantasy.

I wish I could say the same for her latest, **The Paradise Tree.** This one is set in the same locale, inspired by the same tribe of neopagans that seem to occupy that portion of California, and it brings back some of *Brisangamen*'s characters, though they are not central here, but peripheral enablers of the starring players. And it too brings ancient magic to life. But that magic is Qabbalah, all angels and demons contending for mastery of Earth through human agents, and perhaps because that magic is less familiar to most of us, while devil stories are *too* familiar, the life seems strained. Add to this the tale's self-conscious reflection of a computer game, which makes the plotting seem simplistically rigid, and you have a story that is easy to pass up.

The story begins with Ruth Racusak, a divorced free-lance computer programmer who must somehow find time for the game she is programming, the son she must take on weekends, and Ariel, the friend who has just found yet another guru. She goes with Ariel to witness the latest, Joseph Roman, and learns too late that he has a novel drug, stolen from a college graduate student. Ruth survives. Ariel flips out. Roman, pressured by Abaddon, emissary of evil, pursues the student. Ruth finds Del Eden, owner of an occult bookstore, learns to evoke the images of the Archangels for protection, and begins to study Qabbalah. She finds allies in her drive to save Ariel, she confronts Abbadon himself, and the Abaddon within, the residue of the college gang-bang frozen within her core, and then —predictably—she thaws.

The other characters change too. The student wises up. Ariel, like Ruth and the gardener, learns something of love. But most of all we have Roman, the fraud, who becomes an impressed dupe, a victim, and finally a rebelling innocent, and thereby becomes a strong example of the character created by contradicting cliches.

But . . . mystic passes, devilish emissaries, good witches, forces of evil confronting those of good, these are elements of far too many fantasies. Paxton showed a vigorous, original hand with *Brisingamen*. With *The Paradise Tree* she takes the magic too seriously, forgetting to laugh. She tries too hard to repeat her success, and she fails.

The cover of Paula Volsky's second novel proclaims that "There's good luck. There's bad luck. And there's **The Luck of Relian Kru.**" The only possible conclusion the bemused book-seeker can draw, as he or she stands before the rack, is that here is a tome of hyperbolic slapstick, perhaps in the mode of Piers Anthony. The artwork helps, too, for it shows beauty, beast, youth, and gawky demons in a scene that hints of delightful fantasy.

Alas, the tale is a severe disappointment. It has its ludicrous and its dramatic moments, but the plot is trivial and the humor is inconsistent. Relian Kru is a scion of nobility marked by long, double-jointed "wormfingers" and exiled because he is accompanied by an aura of disaster. We see a hint of his history before he becomes the un-

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willing guest of a wizard, Keprose, who craves an apprentice-cum-slave. The situation invites plenty of bad-luck slapstick, but Volsky abandons that thread in favor of pedestrian adventure—Relian in quest of petrified hearts, venomous birds, and free-living hands to aid Keprose's efforts to clone himself, Relian in love with Keprose's female apprentice/slave/fiancee Mereth, Relian pursued by an assassin. The humor, such as it is, shifts to the wizard's pets, two metal snakes that twine around Relian's and Mereth's throats and command them hither and thither at Keprose's behest.

I suspect Volsky's model is Jack Vance, for her characters' names have the Vancian quirky angularity. There are also signs that she aspires to Vance's style of lush description, but here too, as with the consistency of her humor, she falls short. She does not fulfill the promise of her cover.

Worthy of note: The *Creature Features* publisher, John Stanley (Creatures at Large), has just released the first volume of Robert Bloch's youthful tall tales, **Lost in Time and Space with Lefty Feep,** with introductions by Chelsea Quinn Yarbro and Stanley. Lefty is a Damon Runyon guy in a zoot suit with a reet pleet who tangles with Catskills dwarfs, gangsters, the Pied Piper, magicians, flying carpets, wizards, and advertisng. The stories, dating from the early 1940s, with one additional written for the book, are rich with puns and other bad jokes, and they are a definite "don't miss" for nostalgia freaks, Bloch fans, and all who don't mind chuckling themselves to sleep at night. And Stanley promises two more volumes.

ANADEMS

Did you enjoy the excerpts from Ben Bova's **Welcome to Moonbase** that appeared in the June and July 1987 issues? Then you'll be delighted to hear that the book is now available from Ballantine. The galleys landed on my desk just the other day (way back last June!), and the book will be a trade paperback, about 232 pages long, with four-color artwork, for $9.95. ■

● "... an engineer is a man who can do for ten shillings what any fool can do for a pound ..."
Nevil Shute (Nevil Shute Norway), 1954

"You sure he doesn't have that backwards?"
Aerospace corporation engineering supervisor, about 1967
(Submitted by Tom Pace)

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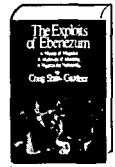

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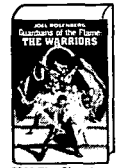

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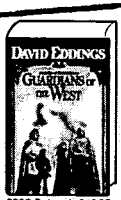

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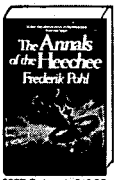

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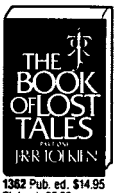

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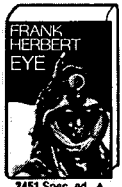

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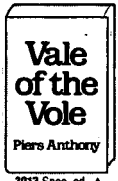

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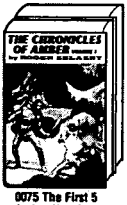

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